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BULLETIN

OF THE

UNITED STATES FISH COMMISSION.

VOL. XX,

FOR

1900.

FIRST PART.

GEORGE M. BOWERS, Commissioner.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.

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INVESTIGATIONS

OF THE

AQUATIC RESOURCES AND FISHERIES OF PORTO RICO

BY

THE UNITED STATES FISH COMMISSION STEAMER FISH HAWK

IN

1899.

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PREFACE.

Soon after Porto Rico came into the possession of the United States the Commission of Fish and Fisheries made arrangements for an investigation of the waters in and about the island with reference to their fauna and their fishery resources; and in December, 1898, the steamer *Fish Hawk*, with a corps of specialists, was sent to the island for this purpose, remaining there until the latter part of February, 1899. Large collections of water animals were made, the knowledge of the fauna of the island and the West Indies in general was greatly extended, and the economic fisheries were carefully considered.

On the return of the expedition the collections were distributed among specialists for study and report, with a view to the publication of a comprehensive work on the animals of the fresh and salt waters of the region. The meagerness of information on this subject and the demand for authentic data which would follow the influx of new people and the development of the fishing industry appeared to warrant the issuance of a bulletin which would contain descriptions of the animals and illustrations of many of the most important ones.

The specimens representing the following groups were assigned to the persons named, whose reports are contained in the two volumes composing the present bulletin:

Fishes: Prof. B. W. Evermann and Mr. M. C. Marsh, U. S. Fish Commission.
Mollusks: Dr. W. H. Dall and Mr. Charles T. Simpson, U. S. National Museum.
Brachyurans and Macrurans: Miss M. J. Rathbun, U. S. National Museum.
Anomurans: Dr. James E. Benedict, U. S. National Museum.
Stomatopods: Dr. Robert P. Bigelow, Massachusetts Institute of Technology.
Isopods: Dr. H. F. Moore, U. S. Fish Commission.
Cirripeds: Mr. Maurice A. Bigelow, Teachers' College, Columbia University.
Polychætous Annelids: Prof. A. L. Treadwell, Vassar College.
Leeches: Dr. J. P. Moore, University of Pennsylvania.
Nemerteans: Dr. Wesley R. Coe, Yale University.
Echinoderms: Prof. Hubert L. Clark, Olivet College.
Alcyonarians: Prof. Charles W. Hargitt, Syracuse University.
Stony Corals: Mr. T. W. Vaughan, U. S. Geological Survey.
Actinians: Dr. J. E. Duerden, Institute of Jamaica.
Sponges: Prof. H. V. Wilson, University of North Carolina.
Foraminifera: Dr. James M. Flint, U. S. Navy.

In addition to the foregoing articles, a general report on the investigations is given by Prof. B. W. Evermann, who was in charge of the expedition, and a chapter on "The fisheries and fish trade of Porto Rico" is contributed by Mr. W. A. Wilcox.

By joint resolution, approved May 14, 1900, Congress ordered the printing of a special edition of 7,500 copies of the general report of the expedition and of the parts relating to the fishes and fisheries. In compliance therewith the matter covered by pages 1 to 350 and plates 1 to 52 of the first part of this bulletin was issued as a Congressional document.

A summary of the scientific results of the Porto Rican expedition has been prepared by Professor Evermann, and appears immediately after this preface.

George M. Bowers,
Commissioner.

SUMMARY OF THE SCIENTIFIC RESULTS OF THE FISH COMMISSION EXPEDITION TO PORTO RICO.

By BARTON WARREN EVERMANN, Ph. D.,
Naturalist in charge of the expedition.

The expedition of the United States Fish Commission steamer *Fish Hawk* to Porto Rico in the winter of 1898–99 had for its primary object a general study of the aquatic resources of that island. The fishes and fisheries naturally received most attention, but every opportunity was embraced to make extensive collections in all other groups of aquatic animals. A considerable collection of algæ was also made.

As stated in the preface to this Bulletin, these collections were assigned, for study and report, to specialists in the various groups. Seventeen reports have been received from those who kindly undertook the critical study of the collections assigned them. These reports were each first published as separate pamphlets, and all are now brought together in the two volumes constituting the Bulletin of the Fish Commission for 1900.

Owing to conditions lying without the control of the Commission, no reports have been received from the specialists to whom the few remaining groups were assigned.

The *Fish Hawk* arrived in the harbor of San Juan, Porto Rico, on the morning of January 2, 1899, and the investigations were begun by the naturalists on the afternoon of that day. From San Juan the vessel cruised entirely around the island, making stops of one to several days each at Aguadilla, Mayaguez, Puerto Real de Cabo Rojo, Ponce, Arroyo, Hucares, Fajardo, Isabel Segunda on Vieques Island, and at Ensenada Honda, Culebra Island. Two trips were made to St. Thomas for coal. With these places as centers of operation, work was done by the vessel and by shore parties at various places in the vicinity of each. Expeditions were made by shore parties to Arecibo, Bayamon, Caguas, Yauco, Aibonito, and El Yunque.

Returning to San Juan February 21, the investigations were brought to a close, and at noon of the next day the *Fish Hawk* sailed for Key West.

The number of days spent about the island was therefore fifty-two, but the actual number of days during which investigations could be carried on was only about thirty-eight. When the brief time devoted to the investigations is considered, the results are highly satisfactory, as is shown by the summary here given.

The results have been published in 20 different articles or special reports, covering a total of nearly 1,000 pages, with 51 colored plates, 75 other plates, 195 text figures, and 3 maps.

An examination of the several reports shows that the collections made by the expedition contain a total of 1,582 species of animals, among which are 9 new genera and 194 new species. The number of species obtained in each group, and the number of new genera and species in each, are shown in the following tabular statement:

Group.	Total number of species listed.	Number of new genera.	Number of new species.
Fishes	291	3	33
Mollusks	653	....	42
Brachyurans and macrurans	221	2	27
Anomurans	53	1	9
Stomatopods	5	....	2
Isopods	17	2	8
Cirripeds	4	....	....
Polychætous annelids	85	....	32
Leeches	2	1	2
Nemerteans	8	....	3
Echinoderms	87	....	8
Alcyonarians	26	....	5
Stony corals	32	....	2
Actinians	13	....	1
Sponges	49	....	20
Foraminifera	36	....	....
	1,582	9	194

The following is a complete list of the papers resulting from the *Fish Hawk* expedition, together with a list of all the new genera and species described in each. Following each title is given the actual date of publication of each paper in which new species are described, and following each new name is given the page upon which it occurs in the original paper:

Wilcox, W. A.—Notes on the Foreign Fishery Trade and Local Fisheries of Porto Rico. <Rept. U. S. Fish Com. for 1899, pp. 1 to 34, plates 1 to 6.

Evermann, Barton Warren, and Marsh, Millard Caleb.—Descriptions of new genera and species of Fishes from Porto Rico. <Report U. S. Fish Com. for 1899, pp. 351 to 362. Date of publication, December 19, 1899.

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Evermann, Barton Warren.—General report on the investigations in Porto Rico of the United States Fish Commission steamer *Fish Hawk* in 1899. <Bull. U. S. Fish Com. for 1900, part 1, pp. 1 to 26.

Wilcox, William A.—The Fisheries and Fish Trade of Porto Rico. <Bull. U. S. Fish Com. for 1900, part 1, pp. 27 to 48, with 5 text illustrations.

EVERMANN, BARTON WARREN, and MARSH, MILLARD CALEB.—The Fishes of Porto Rico. <Bull. U. S. Fish Com. for 1900, part 1, pp. 49 to 350, colored plates 1 to 49, 3 maps, and 112 text figures. Date of publication, December 29, 1900.

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DALL, WILLIAM HEALY, and SIMPSON, CHARLES TORREY.—The Mollusca of Porto Rico. Bull. U. S. Fish Com. for 1900, part 1, pp. 351-524, plates 53 to 58. Date of publication, November 29, 1901.

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RATHBUN, MARY J.—The Brachyura and Macrura of Porto Rico. <Bull. U. S. Fish Com. for 1900, part 2, pp. 1 to 127 and 129* to 137*, colored plates 1 and 2, 24 text figures. Date of publication, November 28, 1901.

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BENEDICT, JAMES E.—The Anomuran Collections made by the *Fish Hawk* expedition to Porto Rico. <Bull. U. S. Fish Com. for 1900, part 2, pp. 129 to 148, plates 3 to 6, 3 text figures. Date of publication, October 4, 1901.

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[a] This species was described by Doctors Gill and Smith in Science, new series, vol. XI, No. 286, p. 973, June 22, 1900, from a specimen obtained by Mr. George M. Gray at San Geronimo, Porto Rico.

Bigelow, Robert Payne.—The Stomatopoda of Porto Rico. <Bull. U. S. Fish Com. for 1900, part 2, pp. 149 to 160, 13 text figures. Date of publication, October 4, 1901.

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Moore, H. F.—Report on Porto Rican Isopoda. <Bull. U. S. Fish Com. for 1900, part 2, pp. 161 to 176, plates 7 to 11. Date of publication, October 4, 1901.

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Bigelow, Maurice A.—The Cirripedia collected near Porto Rico by the *Fish Hawk* expedition in 1898–99. <Bull. U. S. Fish. Com. for 1900, part 2, pp. 177 to 180.

Treadwell, Aaron L.—The Polychætous Annelids of Porto Rico. <Bull. U. S. Fish. Com. for 1900, vol. 2, pp. 181 to 210, 81 text figures. Date of publication, October 4, 1901.

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GENERAL REPORT

ON THE

INVESTIGATIONS IN PORTO RICO OF THE UNITED STATES FISH COMMISSION STEAMER FISH HAWK IN 1899.

BY

BARTON WARREN EVERMANN,

Naturalist in Charge.

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INTRODUCTION.

Soon after Porto Rico became a part of the United States the Commissioner of Fish and Fisheries decided to make an investigation of the aquatic life of that island. An examination of the literature pertaining to the natural history of the West Indies showed that comparatively little was known concerning the fishes, and scarcely anything of the other aquatic animals or of its aquatic flora. The land animals and plants were better known, but even these had received but scant attention.

Dr. Juan Gundlach seems to have been the only zoologist who had made any considerable collections of the animals of the island. He appears to have made two visits to Porto Rico, the first in 1873 and the other in 1875–76. In June, 1873, he landed at Mayaguez and remained in that vicinity until October 4, when he went by boat to Aguadilla. On November 4 he went to Arecibo, whence he returned to Mayaguez via Quebradillas and Aguadilla. After visiting Guanica about a week he returned to Mayaguez and sailed for Habana December 4. Some of the results of his observations were published by him in the Journal für Ornithologie for 1874 and 1878.[1]

In 1875 Dr. Gundlach made his second visit to Porto Rico, reaching Mayaguez on September 14, but the rains kept him from collecting. Early in January, 1876, he went by boat to Aguadilla, intending to go on to Arecibo, but an epidemic of smallpox prevented him doing so for a time, during which he collected to advantage about Quebradillas. He finally reached Arecibo, however, and also visited Vega Baja and Dorado. On May 19 he reached Utuado and returned to Arecibo July 3. About July 10 he went to Bayamon, where he met Dr. Stahl, with whom he visited San Juan, returning to Mayaguez about a week later. There he remained until August 25, when he sailed for Habana. While at Mayaguez he visited Dr. Domingo Bello y Espinosa, a practicing physician of that city, who was much interested in the botany of Porto Rico. He probably also visited the German vice-consul at Mayaguez, Leopold Krug, who had sent to Berlin some collections of the reptiles and batrachians of the island, which were reported on by W. Peters in 1876.[2]

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[1] Beitrag zur Ornithologie der Insel Portorico. <Journal für Ornithologie 1874, 304–315.
Neue Beiträge zur Ornithologie der Insel Portorico. <Journal für Ornithologie 1878, 157–194.

[2] Peters, W.—Ueber eine von Hrn. Viceconsul L. Krug und Dr. J. Gundlach auf der Insel Puertorico gemachte Sammlung von Sängethieren und Amphibien, so wie über die Entwickelung eines Batrachiers, *Hylodes martinicensis*, Dum. Bibr. ohne Metamorphose. <Mon. Berlin Akad. Wiss. 1876, 703–714, and pl. 1; Reptiles, 705–708; Batrachia, 709–714 and pl. 1.

The various results of Dr. Gundlach's work in Porto Rico were published by him under the general title "Apuntes para la fauna Puerto Riqueña," in the Anales de la Sociedad Española de Historia Natural.[1]

The fishes collected by Dr. Gundlach were studied and listed by Professor Poey. He gives, with brief annotations, a list of 106 nominal species, only 94 of which he identifies. The entire list seems to represent 99 good species. In this paper Poey proposes the new generic name *Monosira* (= *Larimus*) and two new species, *Monosira stahli* (= *Larimus breviceps*) and *Antennarius inops*. The paper is scarcely more than a list and gives nothing as to the habits, abundance, or distribution of the species.

In 1869 Prof. Carl Sundevall published, in the Annals of the Royal Academy of Sciences of Stockholm, a report on a collection of birds obtained in Porto Rico by J. A. Hjalmarson.

Dr. August Stahl, of Bayamon, seems to be the only resident of Porto Rico who has given much attention to the natural history of the island. Though engaged actively in the practice of medicine, Dr. Stahl found time to make not only extensive collections in most groups of animals and plants, but also valuable studies of the archæology of the island. His studies were pursued under many difficulties and discouragements, and most of his collections finally deteriorated and perished. In 1883 he published at San Juan a catalogue of the zoological specimens in his collection which, though a mere list, is possessed of considerable interest.[2] Dr. Stahl's collection contained about 90 species, agreeing approximately with the list given by Professor Poey.

Apparently somewhat more attention has been paid to the botany of Porto Rico than to its zoology. Various publications pertaining to the botany of the West Indies have contained references to Porto Rican plants, besides which have appeared a few papers based chiefly or wholly upon Porto Rican material. Perhaps one of the most important is that[3] by Dr. Domingo Bello y Espinosa, published in 1881.

Dr. Ignatius Urban's work[4] on the flora of the West Indies, recently published, contains a great deal of information concerning the botany of Porto Rico.

In 1884–88 Dr. Stahl published a volume[5] on the botany of Porto Rico, which has considerable value.

In January, 1899, Dr. Charles Frederick Millspaugh, curator of botany in the Field Columbian Museum, spent several days (January 5–23) making botanical collections in Porto Rico and the outlying islands. The results have been published and add materially to our knowledge of Porto Rican botany.[1]

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[1] Vol. vii, 1878, 135–234, Mammals and Birds, and 343–422, Birds, by Dr. Juan Gundlach. Vol. x, 1881, 305–317, Amphibians, by Dr. Juan Gundlach, and 317–350, Fishes, by Prof. Felipe Poey. Vol. xii, 1883, 5–58 and 441–484, Mollusks, by Dr. Juan Gundlach. Vol. xvi, 1887, 115–133, Crustaceans, by Dr. Juan Gundlach.

[2] Fauna de Puerto Rico. Clasificacion Sistemática de los Animales que corresponden á esta Fauna, y Catálogo del Cabinete Zoológica del Dr. A. Stahl en Bayamon, pp. 1–249. San Juan, 1883.

In this book Dr. Stahl devotes chapters to mammals (43–46 and 133–135), birds (47–66 and 136–157), reptiles (67–71 and 158–161), fishes (72–81, 162–167, and 246), insects (82–102 and 169–213), arachnids (103–105 and 214–215), crustaceans (106–110 and 216–220), worms (111 and 112, and 243 and 244), and polyps (123 and 124, and 245).

[3] Apuntes para la Flora de Puerto Rico. <Anales de la Sociedad Española de Historia Natural 1881, 231–304; 1883, 103–130.

[4] Symbolæ Antillanæ seu fundamenta floræ indiæ occidentalis. Vol. i, fasciculus i, 1898; ii, 1899; iii, 1900; vol. ii, fasciculus i, 1900. Berlin, Paris, and London. [Vol. i, fasciculus i, is a bibliography.]

[5] Estudios para la Flora de Puerto-Rico, Folletos i–vi. ii, Las Talamifloras, pp. 191, 1884; iii, Las Leguminosas. iv, Las Calicifloras, 1896; v, Las Rubiaceas y Sinantereas, 1887; vi, Las Gamopétalas, pp. 284, 1885; 1888.

But little has been published concerning the mammals of Porto Rico. Besides the papers by Gundlach and Stahl already mentioned, two short papers[2] have recently been published by Mr. Gerrit S. Miller, jr., of the U. S. National Museum, giving descriptions of two new species of Porto Rican bats.

Concerning the food-fishes of the island absolutely nothing was known except by inference, and nothing was on record regarding the existence, character, extent, or methods of the commercial fisheries. It was known that of the food articles imported by Porto Rico dried cod-fish held an important rank, and that only an inconsiderable part of it came from the United States.

It was believed that an investigation of the aquatic animals and plants of Porto Rico would not only yield important scientific results, but that a study of the fishes and fisheries of the island would prove of mutual commercial value to the island and to the United States; and for the purposes of comparison in the future it was of vital importance that the work be initiated before the modifying influences from the United States began to be felt. The Commissioner of Fish and Fisheries therefore decided to undertake such an investigation at once, and to make it as comprehensive and thorough as possible with the funds and the time which were available.

The principal subjects of investigation were, of course, the fishes and fisheries of the island. This would include a determination of the species of the fishes on and about the island, the distribution, abundance, and habits of each, the value of each as food for man or for other fishes, the location and character of the different fishing-grounds, the species taken on each, the relative rank of the food species, the methods of the fisheries, and the character and extent of the import and export trade in fishery products. Similar investigations concerning the reptiles, mollusks, crustaceans, and all other groups of aquatic animals and plants were also desired, particularly with reference to the native oyster, turtles, and other food species. The opportunity to add to our knowledge of the land animals, especially mammals, birds, reptiles, and batrachians was not to be neglected.

The U. S. Fish Commission steamer *Fish Hawk*, Lieutenant-Commander Richard G. Davenport, U. S. N., commanding, was assigned to the work, and the following persons were selected to carry on the investigations: Dr. Barton W. Evermann (naturalist in charge), Dr. H. F. Moore, Mr. M. C. Marsh, Mr. W. A. Wilcox, and Mr. J. B. Wilson. Mr. A. H. Baldwin accompanied the party as artist to the expedition more especially that the life coloration of the fishes might be accurately depicted. Mr. August Busck, of the U. S. Department of Agriculture, joined the expedition for the purpose of studying the insect fauna of the island. Mr. A. B. Baker, of the National Zoological Park, was also a member of the expedition on behalf of the Smithsonian Institution, chiefly for the purpose of making collections of the land vertebrates.

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[1] Plantæ Utowanæ; Plants collected in Bermuda, Porto Rico, St. Thomas, Culebra, Santo Domingo, Jamaica, Cuba, the Caymans, Cozumel, Yucatan, and the Alacran Shoals, December, 1898, to March, 1899: The Antillean cruise of the yacht Utowana, Mr. Allison V. Armour, owner and master. Field Columbian Museum Publication 43, Botanical Series, vol. ii, No. 1, pp. 1-110. Chicago, March, 1900.

[2] Two new Glossophagine Bats from the West Indies. <Proc. Biol. Soc. Wash., xiii, May 29, 1899, 33-37. [Of these two species, one (*Phyllonycteris bombifrons*) is from a limestone cave near Bayamon.]

The bats of the genus *Monophyllus*. <Proc. Wash. Ac. Sci., ii, March 30, 1900, pp. 31-38. [This paper contains a description of *M. portoricensis*, the type of which came from a cave near Bayamon.]

The investigations extended over 45 days, but included only about 38 days of actual work. Though this period was brief, the results are very satisfactory, and the collections obtained show how rich the Porto Rican aquatic fauna is. Naturally, more attention was given to the fishes than to any other group; nevertheless, the collections along other lines, particularly with the mollusks and crustaceans, have proved exceedingly rich and valuable. At this writing the reports upon the collections in all the groups are not sufficiently advanced to enable a definite statement to be made as to the actual number of species obtained in each group, or the number of new genera and species in each, but it is known that the percentage of new forms in most of the groups is quite high. It must be remembered, however, that the brief time devoted to making the collections and the extent of territory covered precluded the possibility of their being exhaustive.

Further investigations about Porto Rico will be sure to yield additional interesting results. The places which will furnish the largest number of new and interesting forms are the coral reefs about the island, particularly those at Mayaguez, Guanica, Ponce, Arroyo, and Culebra. Dredging will also prove very rich, although destructive to dredging apparatus.

ACKNOWLEDGMENTS.

It is with pleasure that this opportunity is taken to acknowledge the many favors and courtesies shown us by the Government officials and citizens of Porto Rico during our stay on and about that island. Mention must first be made of Maj. Gen. Guy V. Henry, commanding the Department of Porto Rico, and Brig. Gen. Fred. D. Grant, military governor of the district of San Juan, through whose thoughtful consideration we were brought in touch with other United States officials and with various prominent citizens of the island. Capt. James A. Buchanan, collector of customs, gave invaluable assistance to Mr. Wilcox in securing the statistics of the import trade in fishery products. Many kindnesses were received from postmasters at the various places visited, particularly from Mr. Walter Landis, of San Juan. The officers of the United States Army in Porto Rico extended to us every courtesy in their power, and we must make especial mention of Capts. S. Reynolds White and Charles G. Stevenson, of the Forty-seventh Regiment New York Volunteer Infantry, and Lieuts. Matthew G. Addison and Charles M. Leach, of the same regiment, who during our stay at Caguas kindly shared their quarters with us and did everything in their power to make our visit at that place pleasant and profitable. Similar courtesies were shown us by Capt. R. A. Marshall, of the same regiment, stationed at Carolina, where we were also under obligations for most hospitable entertainment at the home of Señor José V. Berrios.

To Lieutenant Foster, of the Nineteenth Infantry, stationed at Ponce, we are under very great obligations for placing an ambulance at our disposal for a trip over the military road from Ponce to Cayey and Arroyo. A similar kindness was shown us by Lieutenant Wright, of the Nineteenth Infantry, stationed at Guanica, in furnishing us conveyance from that place to Yauco.

To Capt. Arthur C. Hansard, of Hacienda La Perla; Señor Don Luis Gonzalez, of Luquillo; Señor Augustini, of Hacienda Catalina; Señor Don Antonio Bianchi, of Añasco; Señor Pablo McAllister, of Hacienda Romana, near Guaniquilla; Dr. A. Stahl, of Bayamon, and Señor Don Ignacio G. Vidal, of Puerto Real, we are indebted for many favors. Captain Hansard and Señors Gonzalez and Augustini gave valuable assistance during our trip to El Yunque Mountain. Señors Bianchi and McAllister placed us under many obligations while at Mayaguez and Ensenada del Boqueron. At Puerto Real, Señor Vidal gave us valuable information regarding the fishes and fisheries of that place; and to Dr. Stahl we are indebted for much interesting information concerning the natural history of the island. Captain Mansfield and Señor Susano Bocanegra, the official interpreter at Aguadilla, did us good service, and we received various kindnesses from Señor Nicholas Molinari, of Isabel Segunda; Señors Miguel Ramirez, Ricardo Amado Fariña, and Guillermo R. Scamaroni, of Culebra, and Señors Francisco Trinidad and Emile Just, of Rio Grande.

Mr. Oscar Riddle, teacher of zoology in the Model and Training School of San Juan, furnished valuable information concerning the fishes of the San Juan market, and Dr. W. C. Kendall, of the U. S. Fish Commission, rendered important service during the study of the collections. Dr. J. D. Milligan, the ship's pharmacist, assisted Mr. Baker in collecting the birds of the island, and through his untiring efforts specimens of the Porto Rican parrot and other rare species were added to the collection.

For the Puertoriqueños as a people we have only words of praise. Wherever we went we received from them the most kind and cordial treatment.

GEOGRAPHICAL FEATURES OF PORTO RICO.

POSITION AND SIZE.

Porto Rico is the most easterly and the smallest of the Greater Antilles. It lies between 65° 16′ and 67° 16′ west longitude and 17° 54′ and 18° 31′ north latitude; that is, about 1,500 miles south of Maine and 600 miles east of Washington. It is in the same latitude as Haiti, Jamaica, Guatemala, Bombay, and the northern end of the Philippines. It is 1,500 miles from New York, 1,300 from Norfolk, or 1,000 from Key West. It is about 95 miles long and 35 miles wide, and its area is in round numbers 3,600 square miles, or about three times the size of Rhode Island, or one-tenth that of Indiana. The coast line is about 360 miles, which is 1 mile for every 10 square miles of area. It is quite regular in form, the long diameter being east and west, and the north and south shore lines are approximately parallel. The shore lines at the east and west ends are less regular. The northern coast extends east and west in a comparatively straight line.

HARBORS.

The only harbor on the north side of the island is that of San Juan, which is partly surrounded by mangrove swamps and is protected at its mouth by Cabras and Cabritas islets and some dangerous banks. There is an anchorage off Arecibo, which is safe, however, only in favorable weather. On the northwest and west are anchorages or coves at Aguadilla, Rincon, Añasco, Mayaguez, Puerto Real de Cabo Rojo, and Ensenada del Boqueron. The broad bay at Aguadilla is formed by Capes Borinquen and San Francisco. The cove at Rincon is shallow, and protected only by Cape San Francisco on the north. That at Añasco is a somewhat deeper indentation, protected, however, only at the north by Punta de la Cadena. The harbor at

Mayaguez, lying between Punta de Algarrobo and Punta de Guanajibo, is scarcely more than an open roadstead and affords safe anchorage only during the favorable season. Puerto Real de Cabo Rojo and Ensenada del Boqueron also have safe anchorage only when the winds are favorable. The south coast has a larger number of bays or other indentations, but the only harbors which vessels of regular draft can enter are Guanica, Ponce, and Jobos. Guanica Bay is a spacious basin, completely landlocked, and with adequate depth of water. The entrance to this beautiful harbor is only about 100 yards wide, with high hills on either side. The large bay at Ponce is simply a broad, open roadstead. Jobos Harbor, some 35 miles east of Ponce, has recently been found by the U. S. Coast and Geodetic Survey to possess a good depth of water and to be exceptionally well protected. Arroyo, the port of Guayama, has a fairly safe roadstead. At the east end of the island is a pretty safe harbor inside of Punta Lima and Cayo Santiago, near Hucares and Punta de Santiago, the ports, respectively, of Naguabo and Humacao. A similar harbor is found at Puerto de Fajardo, between Punta de Mata Redonda and Cabeza de San Juan.

COASTS.

The northern shore of Porto Rico rises nearly everywhere abruptly from the sea, with very little beach anywhere. There is but a narrow strip of shallow water, and less than 100 miles offshore is the Brownson Deep, one of the deepest holes in the world, where soundings of 4,561 fathoms have been taken. This coast is also remarkably free from fringing islets. The east and west ends of the island are lower and have considerable stretches of sandy or gravelly beach, with an occasional mangrove swamp and a few small islets fringing the shore. The south coast is nearly everywhere low, with long reaches of sandy beach and mangrove swamp. This shore, as well as portions of the east and west shores, is fringed throughout much of its length by beautiful coral reefs composed chiefly of fan, stag-horn, and brain corals. The small keys along the coast are also often surrounded on one or more sides by coral reefs.

TOPOGRAPHY.

Viewed from the sea, as one approaches Porto Rico from the north, the scene is one of very great beauty. The island appears as a great mass of remarkably rough, irregular mountains, rising abruptly from a narrow coastal plain, and in many places astonishingly steep. Seen from the north these mountains are steep, but beautifully rounded and covered to their summits with rich green vegetation. As seen from the south the slopes are longer, the individual peaks less numerous, and the vegetation not so luxuriant. As has been well said by Mr. Robert T. Hill—

> There is little regularity in the arrangement of these mountains; there is no definite crest line, but the peaks rise from a general mass, whose sloping sides are deeply corrugated by drainage ways. Their surface has been etched by erosion into innumerable gabled lateral ridges (or cuchillas), separated by deep V-shaped gorges. * * * The main range of mountains extends from Mayaguez through Adjuntas and Aibonito to Humacao on the east. This is the Cordillera Central west of Aibonito and the Sierra de Cayey east of that place. Near the center of the island a range[1] bifurcates from the main line and runs to the northeast as the Sierra Luquillo.

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[1] This range contains El Yunque, the highest peak on the island. Its height probably does not exceed 3,300 feet, and the summits elsewhere seldom exceed 2,000 or 2,800 feet.

GEOLOGY.

Mr. Robert T. Hill gives the following account of the island:

> Porto Rico consists of three geologic elements: (1) A central system of deeply ribbed and corrugated mountains, with V-shaped gorges and ridges; (2) lower hills, forming irregular bands along the north and south coast; (3) playa plains, consisting of alluvial soil, occupying old reclaimed estuaries, which extend from the foot of the central mountains across the line of foothills to the seashore. It is roughly estimated that nine-tenths of the island is of the mountainous character, and that the remaining tenth is of the foothill and playa character. The central mountains are composed of water-sorted volcanic ejecta—tufas and conglomerates—with occasional dikes and masses of interbedded subcrystalline bluish limestone of rare or exceptional occurrence, all of which is entirely decayed at the surface, breaking down into red clay resembling that of the southern Appalachians. The dikes are of hard, black, igneous rock, with small white porphyritic crystals. In the east the substructure is said to be granites, especially syenites. In Naguabo and in Mayaguez some serpentine rocks have been observed. The foothills are composed exclusively of rocks of sea origin, consisting of the peculiar type of tropical white limestones, of a loose-textured, chalky, marly, and shelly nature, of various degrees of induration. The rocks of the central mountain region are of Cretaceous and possibly early Eocene age; at least, no evidence tending to establish other dates for their formation has been as yet discovered. The white limestones of the coastal hills are all of later Tertiary and Pleistocene age. The playa deposits are alluvial formations, consisting usually of a rich, chocolate-colored, sandy loam.

CLIMATE.

Porto Rico is well within the torrid zone, but, lying toward the eastern limits of the Greater Antilles, its climate is favorably modified by the prevailing winds and rendered far more agreeable than in any other island of the West Indies. The trade winds, modified by the high mountains of the interior of the island, give it not only a moderate temperature, but they cause the peculiar distribution of precipitation which characterizes it. Though the area of the island is small, nevertheless the extremes of climate, particularly the rainfall, are very great. The annual precipitation on the southern coast seems to be only about 20 inches, while on the northern side it ranges from 55 to 123 inches. It is even said that there is an authentic record for 13 months, chiefly in 1893, when not an inch of rain fell at Guayama, and the records at Cabo Rojo show one period of three years when no rain fell. This difference in precipitation between the north and south sides of the island is shown by the character of the beds of the streams, those of the south being more dry and full of rocks and bowlders.

In the following tables are given certain meteorological data for seven places in Porto Rico, compiled from the reports of the United States Weather Bureau.

Climatological data for year ending April 30, 1900.

Locality and month.	Temperature.					Precipitation.			Sky.			Prevailing direction of wind.
	Mean.	Highest.	Date of highest.	Lowest.	Date of lowest.	Total.	Greatest in 24 hours.	No. of rainy days.	No. of clear days.	No. of partly clear days.	No. of cloudy days.	
San Juan:	°*F.*	°*F.*		°*F.*		*Inches.*	*Inches.*					
May	78.7	89	3	68	1	2.59	0.85	12	11	18	2	SE.
June	79.4	91	22	71	6	7.23	1.42	28	7	17	6	E.
July	79.7	87	2	70	8	7.53	3.60	22	11	16	4	E.
August	80	88	29	71	20	10.38	5.53	19	14	12	5	E.
September	80.6	91	11	71	30	13.66	3.76	20	13	11	6	SE.
October	79.5	90	10	68	1	10.21	2.73	20	6	12	13	SE.
November	78.8	88	29	70	19	11.81	2.57	16	11	14	5	SE.
December	76	88	2	65	26	2.10	.49	10	18	11	2	NE.
January	75.6	86	1	68	15	3.93	.75	21	13	18	0	E.
February	75.7	86	25	66	19	2.13	.70	13	12	15	1	E.
March	75.8	89	31	67	7	1.57	.71	11	14	16	1	E.
April	77.5	93	25	68	8	5.92?	1.91	19	11	17	2	E.

Climatological data for year ending April 30, 1900—Continued.

Locality and month.	Temperature.					Precipitation.			Sky.			Prevailing direction of wind.
	Mean.	Highest.	Date of highest.	Lowest.	Date of lowest.	Total.	Greatest in 24 hours.	No. of rainy days.	No. of clear days.	No. of partly clear days.	No. of cloudy days.	
Caguas:	°*F.*	°*F.*		°*F.*		*Inches.*	*Inches.*					
May	79	93	20	62	1	1.70	0.80	16	19	6	6	E.
June	79	95	2	65	1–4	6.93	1.30	25	19	6	5	E.
July	79.8	93	*23	63	8	8.47	1.60	23	6	8	16	E.
August	......	......	......	......	......	......	......	......	......	......	......	E.
September	80.7	89	*2	70	*1	3.21	.97	21	16	6	8	E.
October	77.8	90	*21	64	*3	9.36	2	21	0	16	15	NE.
November	77.4	89	*18	64	1	4.85	.95	20	......	......	......	E.
December	72.5	89	1	55	30	1.50	.33	13	21	4	6	E.
January	72.4	89	6	59	1	1.59	.30	13	......	......	......	......
February	73.3	89	9	59	13	1.62	.40	13	17	0	11	NE.
March	72.3	86	31	58	21	1.01	.28	9	21	10	0	E.
April	75.6	89	*6	61	8	7.42	7	5	24	2	4	NE.
Aguadilla:												
May	79.8	87	25	72	28	6.48	2	13	12	15	4	
June	80.8	87	*6	75	*1	7.40	1.80	12	4	22	4	
July	82	89	23	74	27	4.68	1.30	7	5	23	3	W.
August *r*	80.8	87	6	74	8	†5.35	......	4	2	5	1	N.
September	......	......	......	......	......	......	......	......	......	......	......	
October *b*	78	86	1	73	13	†8.75	1.70	17	3	8	18	N.
November	77.7	84	*11	73	*2	9.38	2.70	14	15	10	5	NE.
December *a*	75.8	83	1	65	20	2.64	.52	8	15	11	4	NW.
January	†78.6	†91	5	†71	*5	†2.96	†.75	8	17	10	4	NE.
February	78.6	88	27	71	*12	1.32	1	4	21	7	0	NE.
March	78.6	92	28	69	16	.18	.18	1	24	6	1	NE.
April	79.8	88	*27	72	9	5.31	1.52	8	14	13	3	E.
Mayaguez:												
May	......	......	......	......	......	......	......	......	......	......	......	
June	†79.6	89	26	66	27	†10.97	2.19	22	1	4	22	NE. SE.
July	78.7	92	*9	68	*8	14.41	2.10	19	2	0	29	SW.
August	78.2	90	*6	67	*3	19.02	8.40	11	5	0	26	NE.
September	......	......	......	......	......	......	......	......	......	......	......	
October	82.4	89	*8	73	*1	8.73	1.15	21	......	......	......	SW.
November	......	......	......	......	......	3.52	1.20	10	10	10	10	SE.
December	77.6	91	1	62	25	1.04	.50	3	22	5	4	NE.
January	76.6	91	5	63	14	1.49	.48	12	11	12	8	SE.
February	76.4	91	18	63	*2	1.06	.85	5	15	7	6	SE.
March	77.1	93	31	64	*16	1.21	1.12	3	9	19	3	NE.
April	77.9	92	25	62	3	5.44	1.23	15	11	4	15	NE.
Fajardo:												
May *m*	80.4	89	*20	69	31	1.25	0.35	9	......	......	......	
June	80	88	*12	71	*3	5.88	1.55	27	17	8	5	NE.
July	81.6	89	*3	69	28	5.58	1.30	19	21	4	6	NE.
August *a*	82	91	28	72	31	6.21	5	11	......	......	......	
September	81	90	*5	70	30	6.13	1	15	......	......	......	
October	79.1	89	*3	68	10	17.07	4.40	19	17	8	6	
November *b*	78.8	88	27	70	*2	†17.80	5	20	12	12	4	
December *i*	74.9	86	10	60	*25	.79	.30	5	22	0	0	NE.
January	76.2	85	*4	63	1	4.44	1	18	20	8	3	NE.
February	76.4	86	*26	67	*19	.65	.10	9	23	5	0	NE.
March	76.3	86	2	65	12	2.15	1.40	8	27	3	1	
April	78.6	89	25	65	6	13.77	8.45	16	19	7	4	NE.
Hacienda Perla:												
May	78	89	5	68	7	6.79	1.87	20	......	......	......	
June	78.2	87	21	69	3	11.17	2	30	......	......	......	
July	80.1	95	31	72	*5	10.60	1.74	30	......	......	......	
August *b*	80.8	90	2	73	*1	13.65	......	21	21	0	10	E.
September	80	88	*13	72	*1	14.98	1.98	27	8	0	22	E.
October	78.9	87	8	72	*3	17.74	4.48	27	15	0	16	E.
November	78.6	88	13	69	*2	29.52	9.30	26	15	0	15	E.
December	74.2	86	*1	63	*24	4.86	1.09	19	20	0	11	E.
January	73.8	85	1	63	9	9.69	1.37	29	5	0	26	E.
February	73.8	84	*7	65	*8	3.17	.63	23	20	0	8	E.
March	74	88	31	63	22	5.36	2.84	20	24	0	7	NE.
April	76.6	89	5	63	*8	23.08	10.70	29	17	4	9	NE.
Vieques:												
May	78.6	91	19–22	68	*3	3.26	1.45	4	27	2	2	SE.
June	79.4	90	16–30	68	15	5.68	1.12	17	18	9	3	SE.
July	78.6	90	5	69	10	6.45	2.30	13	21	7	3	E.
August	78.4	90	25	59	8	7.03	5.30	11	19	10	2	SE.
September	81.3	93	13	73	22	8.25	1.10	13	13	13	4	SE.
October	81	91	*2	68	*29	10.43	2	10	20	6	5	S.
November	76.8	86	*17	68	*4	16.99	6.26	12	14	8	8	E.
December	75.1	86	*1	62	24	.30	.20	2	28	3	0	E.
January	76.9	89	29	68	*23	6.15	1	15	16	9	6	E.
February	76.2	89	*24	67	*4	3.85	.70	15	16	8	4	NE.
March	76.4	86	*12	67	*2	2.65	1.45	6	27	2	2	SE.
April	78.4	88	15	69	8	9.78	8	8	8	18	4	SE.

*And other dates. †Incomplete. *a*, *b*, *c*, *m*, *r*, etc., =1, 2, 3, 13, 18, etc., days missing from record.

HYDROGRAPHY.

The rivers of Porto Rico are remarkable for their great number, their shortness, the restricted areas of their catchment basins, and the rapid descent which they make from their headwaters in the central mountains to the sea. The precipitation is in most parts of the island very great and, with the multitude of streams, the island is unusually well watered. Moreover,[1] because of the steepness of the slopes, especially on the northern coast, and the impervious character of the clay soil which covers them, the proportion of precipitation which runs off makes these rivers of even larger volume than would otherwise be expected under corresponding conditions. Into the northern ocean flow 12 streams of considerable magnitude; toward the west coast flow 4 of relatively equal size; into the eastern sea flow 5 of less magnitude, and into the southern sea flow 17 of considerable size but comparatively small perennial volume. There are between 1,200 and 1,300 streams and branches of less volume, but yet of sufficient size to have received separate names.

Since the average width of the island is but 35 miles and its extreme length but 95 miles, while its commanding summits range in altitude from 2,800 to 3,300 feet, it is evident that the slopes are steep, the fall of the rivers great, and the velocity of their waters high. Moreover, as the main summits of the dividing mountain ranges have been shown to be one-third nearer the southern and eastern coasts than the northern and western, it is also evident that such streams as flow north and west are three or four times as long and drain ten to fifteen times as great areas as those flowing to the south and east. The former have average lengths of 25 to 40 miles, measured along their stream beds; the latter have lengths of but 5 to 15 miles. For these and reasons already given the streams flowing north and west necessarily have less abrupt slopes than do those which drain eastward and southward, which plunge from an altitude of 3,000 feet to sea-level within a comparatively few miles.

It is thus seen that, as the island is divided climatologically into two distinct portions, it is similarly divided hydrographically, largely as a result of the same causes—the trade winds and the topographic configuration of the surface.

The twenty-eight larger rivers have their sources high among the summits of the Cordillera Central. Those flowing to the north and west are characterized by precipitate descents of 1,000 to 2,000 feet in the first 5 miles of their headwaters. Thereafter they flow more leisurely and with consequent increased size to within 5 miles of the coast. There they emerge practically at sea-level in long meandering curves through the alluvial playas about their mouths. Because of the lowness of their grades near the coast and their resulting low velocity all are of considerable width and moderate depth in the playa levels. A few miles inland, where they flow over steep, rocky beds, their channels are narrow and often confined by precipitous rocky walls, their width is of but comparatively few feet, their depth often less than a foot, and their velocities so high as to render them veritable mountain torrents.

On the southern coast the larger rivers have bed-widths as great as those which enter the northern and western coasts. Their lengths, however, are so short for the same fall that they are not characterized by the long stretches of low, meandering grade found near the coast in the playas to the north. They emerge, on the contrary, from the mountains at but 4 to 5 miles from shore line at altitudes of 200 to 400 feet, and as a result this elevation is passed with comparatively steep slopes over rocky or bowlder-strewn channels. Above these coastal stretches and within the mountains the lengths of the rivers are so short for the relatively great heights which they fall that their dimensions are little greater than those of the smallest brooks which flow from the hill summits in the Rocky Mountains.

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[1] Mr. H. M. Wilson, of the U. S. Geological Survey, made a study of the water resources of Porto Rico in January, 1899, the results of which have been published as "Water-Supply and Irrigation Paper of the U. S. Geological Survey No. 32." We have made free use of this excellent report in our account of the hydrography of the island, sometimes copying literally, without quotation marks.

The rivers of the north and of the west are more like the streams of humid regions in the United States, as their perennial discharge is always fairly well maintained. The larger of these rivers have at low-water stage bed-widths of 150 to 200 feet, average depths of 2 to 4 feet, and minimum discharges of 250 to 1,500 second-feet. In time of flood, although these rivers attain maximum discharges of 10,000 to 20,000 second-feet, these volumes are not greatly in excess of the flood discharges of the rivers of the southern slopes.

The width of stream-beds of the southern rivers is often as great as that of those entering the northern coast, but owing to the infrequency and small amount of the precipitation and the relatively porous character of the soil, reducing the percentage of run-off, as well as to the smallness of their catchment basins, they discharge minimum volumes of but 50 to 100 second-feet. These streams resemble the rivers of our Western plains in that their beds are nearly dry the larger part of the year, but they are yet of sufficient capacity to discharge great volumes during the sudden floods to which they are subject. The beds of these rivers, even near the coast, are bowlder-strewn and from 100 to 300 feet in width. The depth of their banks is 10 to 20 feet, yet the minimum surface-width of such streams is but 50 to 100 feet and their average depth 0.5 to 1.5 feet during their minimum discharge. In maximum flood such streams reach discharges aggregating 5,000 to 10,000 second-feet, in some cases even more, as shown by their wide, rocky, dry beds.

Though the number of streams and branches which have received names is said to be over 1,200, the number named on the best maps does not exceed 100. On one map 81 streams have received separate names; of these, 43 flow directly into the ocean, while the remaining 38 are tributary to them. Probably not over 50 of the entire number would be called rivers in the United States.

In the mountains the water in most of the streams is usually exceedingly clear, but in the lower portions it is often muddy, although the streams examined by us in January and February were, as a rule, quite clear.

Our opportunities enabled us to examine only a few of the streams and only in the most general way. The following brief descriptions of some of the principal ones examined are based partly upon our own observations and partly upon those of Mr. H. M. Wilson.

Rio Loiza.—This is perhaps the longest river on the island. It has its source well toward the south where the divide is near the southern coast, northeast of Guayama, flows near the towns of San Lorenzo, Caguas, and Carolina, and enters the ocean about 15 miles east of San Juan. At Carolina it is a broad, shallow stream, with sand and gravel bottom and moderately clear water, and when seen by us (February 20) the ford near there was perfectly safe for carriages, the water probably not exceeding 2.5 feet in depth. Mr. Wilson gaged this river near Carolina in January and reports it as averaging 220 feet wide, 3 feet deep, and having a minimum discharge of 16,000 second-feet. The Rio Loiza was also examined at the hacienda of Señor Nicolas Quinones, about 2 miles to the east of Caguas, where it is a considerable stream, from 40 to 100 feet wide, with a rather swift current. The depth is in most places less than 3 or 4 feet, though there are places of greater depth. There is a good ford at the hacienda. The bed of the stream is in most places of sand or gravel, though some muddy reaches were observed, and rock bottom occurs where the stream cuts against a hill. Usually one of the shores is low, sloping up gradually 2 to 5 feet to a level bottom covered with meadows and fields of tobacco and cane. On the other side the shore rises abruptly into wooded mountains of moderate height. At the hacienda there is low bottom land on each side.

The *Rio Caguitas*, a tributary of the Rio Loiza, is crossed twice by the Caguas-Aguas Buenas road just west of Caguas; it then flows northward and eastward around the town and joins the Rio Loiza near the hacienda of Señor Quinones, the road to which crosses it several times. It was examined throughout most of its length from the Aguas Buenas road to its mouth. It is a rather pretty stream, 30 or 40 feet wide and from a few inches to 3.5 feet deep, with much deeper pools at intervals. The shores are usually of clay, sometimes of gravel, one shore generally high, the other low and spreading away into low level river bottom. The bed of the stream is of sand or mud in the more quiet and deeper reaches and of fine gravel where there is some current. The water appears clear and pure and there is usually a fairly strong current. The flow is estimated at 50 second-feet.

On the gravel bars and along the edges was considerable aquatic vegetation, among which were obtained specimens of 4 fresh-water crustaceans, including a sword-shrimp (*Xiphocaris elongata*), 2 prawns (*Bithynis jamaicensis* and *B. olfersii*, the latter numerous), and a crab (*Epilobocera sinuatifrons*).

The temperature of the water at the Aguas Buenas ford at 11 a. m., January 9, was 71°, when that of the air was 77°.

The *Rio Turabo*, another tributary of the Rio Loiza, was examined by Mr. Wilson where it is crossed by the military road near Caguas, and found to be similar to the Caguitas in character and volume.

Rio Bayamon.—This river was examined in the vicinity of the city of Bayamon, and also at its mouth at Palo Seco. It is a stream of some size, having its headwaters near Cidra, on the north side of the divide between Cayey and Aguas Buenas. It flows nearly north, passing just west of Aguas Buenas and by Bayamon, entering the sea near Palo Seco, about 2 miles from San Juan. At Bayamon it is perhaps 35 to 50 feet in average width, with a depth varying from a few inches to 3 or 4 feet. The current is strong, the low banks are of red clay, and the water is usually more or less muddy. The bottom of the stream is chiefly of tough clay or gravel and clay. At the town of Bayamon is a dam which interferes with the free movement of fish.

Rio Arecibo.—This stream rises in the Cordillera Central about Adjuntas and flows northward to the sea at Arecibo. Near Adjuntas, at an elevation of 1,440 feet, it has a minimum discharge of 40 second-feet. A few miles below, at Utuado, its discharge is 100 second-feet. Lower down it receives as tributaries Rio Don Alonzo, Rio Tanama, and other smaller streams, which greatly increase its size.

Rio Culebrinas.—This is a stream of moderate size, rising between Lares and San Sebastian and flowing westward into the sea just below Aguadilla. Near San Sebastian, at an elevation of 140 feet, it has a bed 125 feet wide, a current of 4 feet per second, and a volume of 100 second-feet. At its mouth it is only about 60 feet wide and has a slow current. The bottom is soft mud and sand.

Rio Añasco.—This is of somewhat larger size, with its headwaters on the divide west of Adjuntas, and enters the sea north of Mayaguez. One of its tributaries, the Rio Yahueca, was examined by Mr. Wilson at an elevation of 1,440 feet, 5 miles west of Adjuntas, where the minimum discharge was 20 second-feet. The Rio Blanco, into which the Yahueca flows, at an elevation of 1,350 feet, about 8 miles west from Adjuntas, has a minimum flow of about 50 second-feet. The Añasco River, at a point about 8 miles above the town of Añasco, at an elevation of 80 feet, has a bed-width of 150 feet, a surface-width of 75 feet, a depth of 1.5 feet, and a volume of about 600 second-feet. Below Añasco this river flows through a level playa and has an easy meandering course, its grade being low and the current slow. Its surface-width here is about 200 feet, the depth 4 to 8 feet, and the flow about 1,000 second-feet.

Rio Yauco.—This small stream rises among the hills north of Yauco and enters the sea near Guayanilla. It was seen near Yauco, where it is only a few yards wide and has a small volume. It is used to some extent for irrigation purposes.

Rio Portugues.—This stream at Ponce has a bed-width of 175 feet and a discharge of 60 second-feet. Its total available discharge is much greater, but the major part of it is diverted a few miles above the city for irrigation purposes and for the water-supply of Ponce.

The *Rio Jacaguas*, which is crossed by the military road at Juana Diaz at an elevation of 160 feet, has a width of 180 feet, a minimum surface-width of 50 feet, and a discharge of 50 second-feet. The discharge would be greater, but a portion is used for irrigation purposes above the military road.

Rio Descalabrado.—This is a small stream crossing the military road between Juana Diaz and Coamo, where it has an elevation of 260 feet, a comparatively dry bed 120 feet wide, a 2-foot current, and a discharge of 40 second-feet.

Rio Coamo.—This river has its sources in the Sierra de Cayey and the Cordillera Central south of Aibonito and Barranquitas, and flowing southward, enters the sea east of Ponce. At Coamo the bed of the stream is 360 feet above sea level, and has a bed-width of 100 feet, though its surface-width is somewhat less. Its average depth was about 4 inches and the flow about 100 second-feet.

Rio Guamani.—A small stream rising in the Sierra de Cayey north of Guayama and flowing southward by that town into the sea just east of Jobos Harbor. It is crossed by the military road just west of Guayama, where it is a small creek, a few feet wide and a few inches deep.

Rio Naguabo.—This small river rises on the south slopes of El Yunque and has its mouth near Hucares. Below Naguabo it is sluggish, with mud bottom.

Rio Fajardo.—The Fajardo River rises in the Sierra Luquillo and flows northeast into the sea at Playa de Fajardo. Just south of Fajardo, where it was examined, it flows through a low, level plain, with cane fields on either side. The bed is several yards wide and made up of coarse gravel or larger rocks. Just above the ford the bed was considerably wider than the water surface. The current was about 5 feet per second, and the average depth 2 feet. The water was clear and apparently pure. At its mouth it is deeper and much wider and rather muddy. Its banks are low and largely of mud, in places overgrown with grass. It is navigable for rowboats for a mile or more above its mouth.

Rio Luquillo.—This stream has its sources on the slopes of El Yunque Mountain and flows northward, entering the sea near the village of Luquillo. Different branches of this river were examined at various places on and about El Yunque, where they are all swift, turbulent mountain streams, full of falls, cascades, rapids, and small but relatively deep pools. The bed is usually of rock and is well covered with bowlders of various sizes. The water was always clear and pure and the maximum temperature February 19 was 69°. There was but little aquatic vegetation visible, but small crustaceans (*Atya scabra* and *Xiphocaris elongata*) were quite common. These streams are doubtless not materially different from other mountain streams of this island, particularly those having their sources in dense shade, such as prevails upon the slopes of El Yunque. Although the amount of water is not great, and there are no long, quiet reaches, there is ordinarily a continuous stream of sufficient volume to permit fishes to pass easily throughout the entire length, barring the impassable falls. The deep pools are often of good size. The relatively low temperature and the character of the water, together with the presence of crustaceans, which would afford a food supply to a limited number of fish, render it probable that the small-mouthed black bass might be introduced into these streams with a fair prospect of becoming established. Indeed, a maximum temperature of 69° would not be unfavorable to the rainbow trout, which we have seen in southern California in small streams very similar to those examined on El Yunque, and whose summer temperature is probably no lower. The experiment of planting the rainbow trout in some of these Porto Rican streams and the small-mouthed black bass in others is well worth trying.

Lagoons of Porto Rico.—There are no real lakes on this island, but near the shore are several lagoons. These are usually narrow and relatively long, separated from the sea by a low, narrow strip of sand and surrounded by a dense fringe of mangrove bushes, which makes it difficult to reach them. Some of them have permanent connection with the sea, while others are connected only during times of heavy rain. The water in most of them is strongly brackish or salt, while in a few it is relatively fresh. The fishes frequenting these lagoons are chiefly mullets and snooks ("liza" and "robalo"). The principal lagoons are Tortuguero and Caña Tiburones near Barceloneta, and Guanica and Flamencos near Guanica.

LOCAL INVESTIGATIONS.

When the *Fish Hawk* was assigned to the Porto Rican investigations, it was understood that she would have to return to the United States early in the spring to engage in shad-hatching operations on the North Carolina coast. In order, therefore, to accomplish as much as possible, it was arranged to carry on synchronously four lines of work whenever possible.

1. A party usually consisting of Professor Evermann and Mr. Wilson, assisted by four to six men of the ship's crew, with the steam launch, a flatboat, seines, and other apparatus, would do collecting along the shore, particularly in those places where seining could be done.

2. Another party under Mr. Marsh (sometimes assisted by Mr. Wilson) and four to six sailors using the oil launch would do collecting on the reefs, paying particular attention to the invertebrates.

3. Mr. Wilcox devoted his time to the statistical inquiry, visiting the customs officials, the dealers, and the fishermen. The records in the custom-houses were critically examined as to the extent and character of the trade in fishery products with other countries; the dealers were interviewed, the fishermen were visited, and the methods of the fisheries investigated.

4. Whenever the weather permitted, the *Fish Hawk* was engaged in using the beam trawl or dredge, and in making soundings. This work was under the immediate direction of Dr. Moore, assisted by Dr. J. D. Milligan, the ship's pharmacist.

By adhering as strictly as possible to this general plan a greater amount of work was accomplished than would otherwise have been possible. It frequently happened that one or more of these lines of work was interrupted from one cause or another; and the dredging operations especially, on account of unfavorable weather, the breaking of apparatus, and other causes, were not altogether satisfactory.

The *Fish Hawk* reached San Juan Harbor on the morning of January 2, and preparations were at once begun for field work. During the afternoon of the 2d and the morning of the next day observations were made along the shore of the harbor and on the seaside of the little island upon which San Juan is built, and in the afternoon of the 3d the first collecting was done. With the cutter, Messrs. Evermann, Moore, Marsh, and Wilson went to the head of the harbor, then up Martin Peña Inlet some 4 miles to beyond the railroad bridge and the military road. This inlet is from 30 to 150 feet wide, 2 to 10 feet deep, and extends through low-tide flats covered with a dense growth of low mangrove bushes. The water was more or less stained with vegetable juices and the bottom was usually of black mud or mixed mud and broken shells. The only fishes seen were a few young mullets. Beginning a few rods above the mouth of the inlet and continuing well toward the railroad bridge we found the mangrove stems thickly covered with the shells of the small native oyster (a form of *Ostrea virginica*). The majority of these shells were alive, though many, particularly those highest on the stems, were dead. On these stems we also found many small barnacles, an occasional *Mytilus exustus*, and groups of bryozoans, and among the stems were a good many small crabs and an occasional individual of a larger species with red back and white claws (*Goniopsis cruentata*).

At one place on this inlet the low ground or mangrove swamp is quite narrow on the south side and a considerable hill of cherty limestone rises from near the water's edge. In this hill are three or four small caves in which a few bats were found, apparently all of one species, probably *Artibeus perspicillatus*.

During the subsequent days spent at San Juan other trips were made up this inlet and the boat dredge was used at several places. The bottom, however, proved quite barren, and very little life of any kind was found. Fishes were extremely rare and mollusks and crustaceans were scarcely less so. Among the mangroves several specimens of water birds were seen, the kingfisher (*Ceryle alcyon*), brown pelican (*Pelecanus fuscus*), great blue heron (*Ardea herodias*), little blue heron (*Ardea cærulea*), little green heron (*Ardea virescens*), a species of rail and a sandpiper. On the shore a number of land birds were seen, among them the American redstart (*Setophaga ruticilla*), a fly-catcher called *pitirre* by the natives (*Tyrannus dominicensis*), summer yellow-bird (*Dendroica petechia ruficapilla*), a vireo (*Vireo calidris*), and several others which we did not know and of which no specimens were obtained.

San Antonio Bridge.—At its east end the little island upon which San Juan is built is connected with the mainland by the bridge of San Antonio, which crosses the San Antonio Channel. Several trips were made to the vicinity of this bridge and the shores of the channel just east of it proved to be excellent collecting-ground. At the north end the bottom is of clean, compact sand, with patches of algæ, and the depth soon increases to a fathom or more, while the south shore has a bottom of sand and mud and the depth increases less rapidly. The seine could be operated very well except on the south side, where it would occasionally fill up with mud.

Palo Seco.—Across the bay from San Juan, at the mouth of the Bayamon River, is the little fishing village of Palo Seco. The fishing-grounds are in the river near its mouth, where the water is almost fresh, though dirty from the muddy bottom and débris. The commercial fishing here is principally with gill nets set across the mouth of the river. These are used chiefly for "liza" (mullet). Seines and cast nets are also used to some extent, the principal species taken in the former being "sardina" (*Opisthonema oglinum*), *Caranx hippos*, *Hyporhamphus unifasciatus*. *Oligoplites saurus*, *Polydactylus virginicus*, *Selene vomer*, *Trachinotus*, *Spheroides*. *Gobiesox*, and *Lobotes surinamensis*. The species taken in cast nets were "mojarra" (*Gerres lineatus*) and mullet.

Cataño.—Across the bay, southwest from San Juan, is Cataño, a small village, the shore terminus of the railroad leading to Bayamon, where some fishing is carried on. The shore between this place and Palo Seco is sandy and the depth of water increases moderately. This shore was not particularly good as a collecting-ground, though some species were secured which had not been taken before.

Seashore near San Juan.—The seashore or wall of the little island upon which San Juan is built was examined throughout its entire length, from Morro Castle to Escambron Point and on around to Fort San Geronimo. This coast is chiefly a high, rocky wall, upon which the waves and breakers are constantly thundering. In a few places, chiefly toward the east end, are tide-pools in which, at the proper stage, some small fishes can be found—principally mariposas (*Eupomacentrus* and *Abudefduf*) and gobies. In the little cove between Escambron Point and Fort San Geronimo is a short stretch of sandy beach, the depth increasing moderately and the bottom with a liberal supply of algæ, where fair collecting can be had.

San Geronimo.—The shore between Fort San Geronimo and San Antonio Bridge is also good collecting-ground. This locality was visited frequently by Mr. George M. Gray, of Woods Hole, Mass., during the winter of 1899–1900, and a collection of about 37 species of fishes obtained. Mr. Gray has kindly permitted us to examine his collection and to include the species in the present report. All specimens credited in this paper to San Geronimo belong in the collection made by Mr. Gray.

San Juan market.—During our stay at San Juan (January 2 to 17) it was our custom to visit the San Juan market every morning to learn what species of fishes were handled there, the relative abundance of each, the methods of handling the fish, and the price at which each was sold. Market here, as well as elsewhere in Porto Rico, begins very early in the morning and is practically over by 7 or 8 o'clock. It was therefore necessary to reach the market as early as possible to see the fish stalls at their best. A large number of food-fishes were seen and many valuable specimens were obtained. During the winter of 1899–1900 Mr. Oscar Riddle, in charge of the biological work in the Model and Training School at San Juan, made frequent visits to this market. His excellent training as a naturalist and knowledge of ichthyology enabled him to study critically the fishes found and to gather a large amount of interesting and important information concerning them. He has very kindly furnished us a report embracing the results of his observations and inquiries, and we desire in this place to express to him our deep appreciation of his intelligent interest in this matter and our thanks for the valuable information we have thus obtained. This information will be found in the chapter dealing with the commercial fishes.

Caguas.—While at San Juan a trip was made to Caguas, on the military road, 25 miles (36 kilometers) south from San Juan and near the center of the island from north to south. This place has an elevation of 246 feet above sea-level, and lies in a beautiful valley surrounded by hills of moderate height. The Rio Caguitas flows northward just west of the town, then turns eastward and, after a tortuous course of about 2 miles, flows into the Rio Loiza, near the hacienda of Señor Nicolas Quinones. The seining of this stream was quite satisfactory. Though fishes of considerable size were rare, young fishes were fairly abundant, the following species being represented: *Awaous taiasica*, *Agonostomus monticola*, and *Sicydium caguitæ*. A small shrimp (*Bithynis olfersii*) was very abundant, especially among weeds growing in the water's edge, where the bottom was somewhat muddy. A much larger shrimp, possibly the same species, and a sword shrimp were found in some numbers. Only a single species of water plant, probably *Myriophyllum*, was found in a few places.

The Rio Loiza was examined just above the mouth of the Rio Caguitas, 2 miles northeast of Caguas, where it is 75 to 100 feet wide and 1 to 7 feet deep. One shore is usually low, while the other may be high, rising abruptly into wooded hills. At the hacienda is a ford, and both shores are low. Seining was not very satisfactory. A great many young of the "dajao" (*Agonostomus monticola*) were caught, and a few small gobies were seen. We were told that good-sized examples of "dajao" and "guavina" occur here, and eels are caught in the "nasa," as explained elsewhere. The same crustaceans and mollusks were found here as in the Rio Caguitas.

Bayamon River.—One visit was made to the town of Bayamon, about 6 miles south of San Juan, and the Bayamon River examined near the town, where it is a stream of some size, flowing through a level plain and with red clay banks 2 to 10 feet high. The water was roily from recent rains and somewhat above low-water stage. The river contained considerable aquatic vegetation. At first the seine was hauled downstream in the usual way over the riffles, through the deep holes and through various inviting places, but scarcely anything was caught. Then it occurred to us to see if the fish might not be hiding in the holes under the banks. The seine was stretched lengthwise of the stream parallel with the bank and a few feet from it, and then pulled through the water and up against the bank. Then with sticks we prodded in the holes under the bank to scare out any fishes that might be hiding there, and on lifting the seine we found it usually well filled with moron, guavina, ciaga, dajao, anguilla, camaron, etc. Similar experience was had at Caguas in the Rio Caguitas and the Rio Loiza. Evidently the fresh-water fishes and crustaceans of these rivers have been able to protect themselves from being carried out to sea during high water by occupying protected places in the banks, and this has now become a habit with them. This habit is discussed at length in another portion of this report.

Arecibo.—The *Fish Hawk* did not make any stop at Arecibo, but Professor Evermann and Mr. Wilcox visited it by rail from San Juan. Considerable commercial fishing seems to be carried on here, chiefly in the mouth of the Rio Grande de Arecibo and along the beach in front of the city. No collecting was done here by us, but a few species were obtained from the local fishermen, among them *Elops saurus*, *Auxis thazard*, *Vomer gabonensis*, *Conodon nobilis*, and *Micropogon furnieri*.

Aguadilla.—The *Fish Hawk* spent but one day (January 18) at this place, dredging in the harbor (stations 6055 and 6056), while two shore parties did seining and other collecting at various places near the town, between Punta Borinquen and the mouth of Rio Culebrinas. Just above the town the shore is very rocky and abrupt. There is no beach, and it is possible to get along only by crawling among or over the large and wave-worn rock masses rising abruptly from water several feet deep and upon which the waves are constantly dashing. These rocks were thickly covered with several species of small gasteropods (chiefly *Nerita peleronta* and related species) and a large species of Chiton.

In the bay in front of the town the water increases in depth quite rapidly, so that the use of small collecting seines (50 to 150 feet long) was not very satisfactory. The beach, however, is sandy, and the seines were hauled with fair success. Farther down the beach the depth increased more gradually and the seine collecting was somewhat more satisfactory. Opposite the Columbus monument (marking the spot where Columbus is supposed to have landed November 17, 1493) the surf was too strong and successful collecting could not be done; but nearer the town were found some shoals covered with algæ and other vegetation, where fishes and crustaceans were fairly abundant and good collecting was had, though considerable annoyance was caused by the seine persistently catching on the rocks. A number of food-fishes were obtained from the native fishermen, and on a visit which Mr. Marsh made to Aguadilla by rail from Mayaguez, on January 22, several additional species were obtained.

Mayaguez.—Mayaguez Harbor proved to be an excellent collecting-ground, and all four lines of investigation were carried on successfully each day during the stay at this place (January 19 to 23). The vessel made dredging stations 6057 to 6071, and two shore parties were usually at work. Various good collecting-grounds were found. Perhaps the best was about the mouth of a little creek just above the playa and on and about the coral reefs in the same neighborhood. Here the bottom was of sand, well covered with algæ in many places, and the depth increased only moderately. Some of the most interesting fishes were seined here, among them being species of *Antennarius*, *Eupomacentrus*, *Chætodon*, etc.

The coral reefs here proved exceedingly interesting. They were made up chiefly of fan coral (*Isopora muricata palmata*) and the stag-horn coral (*Isopora muricata*), with which were mixed a good many heads of one of the brain corals (*Platygyra viridis*) and patches of *Pterogorgia acerosa* and *Rhipidogorgia flabellum*, whose long, brightly colored branches, swaying back and forth by the waves, presented a very beautiful scene. In a few places small masses of coral were exposed as the waves receded at low tide, and upon these the brown pelicans would rest; but usually the broad sheets of the fan coral spread out from a few inches to 4 or 5 feet beneath the surface of the water and were never exposed. These sheets were often very broad and very beautiful when observed through 1 to 3 feet of clear, quiet water. Walking about over these reefs was a somewhat hazardous undertaking; the edges of the thin sheets would always break when stepped upon and not infrequently the entire blade would break away, precipitating the investigator among a mass of coral blades with sharp or jagged edges, which would cut or lacerate one's legs and hands in the most painful manner. Then most of these species, at least *Millepora alcicornis*, *Pterogorgia acerosa* and *Rhipidogorgia flabellum*, have the sting cells well developed and render one's condition still more uncomfortable. Swimming about in the open places among the corals, hiding under the spreading blades, and resting quietly in the nooks and corners everywhere, gaily colored fishes could be seen. The most abundant was perhaps *Abudefduf saxatilis*, called "mariposa" by the natives; tangs, cockeye pilots, blennies, the young of several snappers (*Neomænis synagris*, *N. analis*) yellow-tails, parrot-fishes, and scorpænas were also noticed.

Among those coral masses, covered more or less with algæ, were found a good many crustaceans, and down in the interstices were star-fishes and sea-urchins. The most abundant urchin was an exceedingly long-spined species (*Diadema*), the wound from whose spines is very painful. Very few mollusks were found among these corals, but in the shallow water nearer the shore, in the sand, or among the masses of Porites, shells were fairly abundant, though the species represented were few. Decidedly the most abundant was a little *Donax*, which was common just at the water's edge, and, as the waves receded, numbers could be seen hurriedly burrowing themselves in the sand. So quickly would they disappear that it would require prompt action to dig them out before the coming of another wave.

Another good seining-ground was on the sandy beach up the coast for a mile or more above the reef and toward Punta del Algarrobo, in front of a large cocoanut grove which extends along near the shore for considerable distance. The water increased in depth moderately, the bottom was of sand covered with a liberal growth of algæ, and fishes, crustaceans, mollusks, sea-urchins, sea-cucumbers, etc., were reasonably abundant. The most common fishes were the smaller scaroids, such as *Sparisoma xystrodon*, *S. niphobles*, *S. hoplomystax*, *S. flavescens*, and *Scarus croicensis*. The short-spined white sea-urchin (*Toxopneustes variegatus*) was abundant, as was also the large sea-cucumber (*Holothuria surinamensis*).

Considerable work was done with the boat dredge in Mayaguez Bay. The larger part of the bay was covered, but the only dredging-grounds of value were between the coral reefs already described and Punta del Algarrobo. The southern part of the harbor was dead bottom and almost completely barren. The principal objects obtained with the boat dredge were many small crustaceans, including several species of crabs not obtained before, five or six species of sea-urchins, and a few mollusks.

The dredging in this vicinity was somewhat more satisfactory, and some of the stations were particularly rich, especially in bivalves. One station which proved exceedingly rich is No. 6062. The dredge was hauled here in 25 to 30 fathoms over bottom composed of mud, sand, and shells and in about 3 pints of material saved more than 100 species of mollusks were represented.

Puerto Real de Cabo Rojo.—This small bay and vicinity proved very good collecting-ground. The best, perhaps, was along the south side of the small bay, near the cocoanut grove of Señor Don Ignacio G. Vidal. The bay here was well supplied with algæ, the bottom was usually suitable, and fishes were abundant. Much of the shore in this vicinity is covered with mangrove bushes, and it is here that the largest and best oysters are obtained. It was learned that some oysters are occasionally gathered here for the market at Mayaguez and perhaps other towns of the island.

At this place we found fishing boats with live-wells, after the manner of those in common use at Key West. By eliciting the interest of these fishermen we were able to obtain excellent specimens of many important food-fishes, among them several species not previously secured. These fish had been caught chiefly in the basket traps; a few were taken with hand line.

The spade-fish (*Chætodipterus faber*) was seined here in large numbers.

Ensenada del Boqueron.—This open bay is only a few miles south of Puerto Real. Our work on this coast covered practically the entire shore from Puerto Real to Los Morillos de Cabo Rojo at the extreme southwest corner of the island. Just below Puerto Real is a rocky and abrupt section of the shore terminating in Punta de Guanaquilla, a rocky point several feet high, at the north side of Ensenada del Boqueron. The entrance to this bay is quite wide, and as but little protection is afforded, the surf is usually heavy. Much of this shore, however, is good collecting-ground. The best place is perhaps on the north side near the Hacienda Romana of Señor Don Pablo McAllister. Dredging stations 6072–6078 were made off this coast.

Guanica.—Parts of two days (January 28 and 29) were spent at this place. Guanica Bay is one of the best protected harbors in Porto Rico. Inside the harbor the shores are in most places of compact sand over which seines can be drawn without difficulty. At the upper end the water is shallow and vegetation is abundant. In places the bottom is somewhat muddy, but not sufficiently to make shore collecting impossible. Animal life, however, was unexpectedly rare in this part of the bay. On the northeast side of the harbor more fishes were found, but the bottom was rocky in places, which made it difficult to make successful hauls. Specimens of *Chilomycterus* and *Monacanthus* that had not been seen elsewhere were obtained here. Just outside the harbor, on the west side, is a coral reef which was particularly rich in crustaceans, annelids, and other invertebrates. No dredging was done at this place.

Ponce.—The harbor at Ponce is merely an open roadstead, and during our stay there (January 30 to February 2) the water was too rough for satisfactory collecting, except during the early part of the day or in particularly well-protected situations. The places visited were the shore and three small islands westward from the playa and the reef about the Cardona Island light-house, all of which proved exceptionally rich in fishes, mollusks, and crustaceans. A number of new and interesting species of each group were obtained. The shore westward from the playa is of compact sand, and seining can be carried on fairly well as far out as the little islands about Punta de las Cucharas. These islands are low, but dry. About some of them are a few clumps of mangrove. About a very small, naked sand island excellent collecting-ground was found, and here the type of *Doratonotus decoris*, a new and interesting species of labroid fish, was found among the algæ. An old coral reef here also afforded many interesting species. The reef at Cardona Island was visited frequently and proved unusually rich in new and interesting forms, among them three new species and two new genera of fishes (*Gillias jordani*, *Coralliozetus cardonæ*, and *Auchenopterus cingulatus*). No dredging was done by the ship at this place.

Arroyo.—The surf here was too heavy for seining, but the reef at Punta de las Figuras yielded considerable interesting material, and was particularly rich in crustaceans. Other parts of the reef were examined, but proved not so productive as the region near the light-house. Considerable commercial fishing is done at Arroyo, chiefly with basket traps, though haul seines, hand lines, and cast nets are also used; and from fishermen several valuable specimens were obtained, among them being some species of fishes new to the collection. The ship did not do any dredging about Arroyo.

Vieques Island.—The entire north coast of this island is without bays or harbors, and is so exposed that a heavy surf is constantly beating from one end of the island to the other, rendering collecting practically impossible. The south side has four or five well-protected bays and would doubtless prove a rich and interesting collecting-ground. Along the north shore, near Isabel Segunda, the principal town on the island, a few hauls with the seine secured several species of fishes; and in a little creek west of the town some brackish-water species were taken, including young mullet (*Mugil curema*), *Guavina guavina*, robalo (*Centropomus undecimalis*), and hog-choker (*Achirus lineatus*). Specimens of several food-fishes were obtained from the fishermen, and a few other species were collected on the reef near the town.

Dr. Moore visited El Caballo Blanco, a small shoal about 1.5 miles northwest from the town, where he made valuable collections of invertebrates.

Culebra Island.—The shore collecting about this little island was chiefly inside Ensenada Honda and along the neighboring shores outside. This harbor is one of the best as well as one of the prettiest found in Porto Rico, or any of the outlying islands. It is commodious, the depth is sufficient for large vessels, the entrance is very narrow, and it is surrounded by high, picturesque hills. The shores of this bay are usually high and there is little or no mangrove. In most places the depth increases slowly, the bottom is usually well covered with algæ, and there are no rocks which interfere with seining. The place is therefore quite suitable for this kind of collecting, and a good number of desirable specimens was obtained.

Just across the neck of land forming the southwest side of the harbor is an indentation in the coast called "Seine Bay" by the Tortola fishermen. Here the coast sweeps around in a broad, gentle curve with a long beach of clean, compact white sand, which was found to be an excellent seining-ground. In one part of the bay the water is quite shallow, and a considerable area is covered with small masses of dead coral, under and about which many small but interesting fishes were found. By first surrounding one of these masses with a light seine and then lifting the coral mass out of the way, the fishes, crabs, etc., hiding under it could usually be captured. Seining was also successful in several naked open areas or deeper pools, free from vegetation, and with clean, white, sand bottom, in which various species of fishes were seen. The most conspicuous fishes in the pools and about the coral masses were cockeye pilots (*Eupomacentrus* and *Abudefduf*), young snappers, and young mojarras, while under the rocks various species of blennies would be found. Certain species of starfishes and sea-urchins were also common.

Brown pelicans were quite abundant here, as also on the reefs at Mayaguez and Guanica, feeding upon "sardinas" and such other fishes as they could catch.

At the lower or southeast end of this cove a high, rocky point comes down to the water. The shore is very rocky and a rich, live reef comes close in. Attempts were made to collect on this reef, but the surf was too high and little could be done.

The region off this side of Culebra Island is one of the principal fishing-grounds visited by the fishermen from Tortola, St. Thomas, and Santa Cruz. These fishermen make the bulk of their catch in the pots or basket traps. These are usually baited with white chunks of cactus pulp, which probably serve simply as a decoy, and set in 5 to 8 fathoms of water. Each pot has usually three buoys, fastened to it by long, plaited bark or wooden ropes. The principal fishes seen in these pots at the time of our visit (February 7 to 12) were tangs, hog-fish, black grouper, and white grunt.

On the neck of land separating this cove from the harbor is a small lagoon of nearly fresh water, entirely surrounded by such a dense border of mangroves that it was impossible to do any seining in it. Such an examination as could be made did not show that the lagoon contained any fish. About it were seen a few coots, ducks, fishhawks, and kingfishers, as well as various species of land birds.

The reef on each side of the entrance to the harbor was found to be the richest in species of any we visited. Not only were mollusks, crustaceans, annelids, and many other groups well represented, but many species of fishes were found, including several undescribed forms. That portion of the reef east of the entrance was particularly interesting, and the corals there were unusually fine. Our best specimens of the stag-horn coral were obtained at this place.

Dredging stations 6079 to 6095 were made between the islands of Vieques and Culebra, and eastward toward St. Thomas, in depths varying from 6 to 25 fathoms. The bottom at all these stations was of coral rock or coral and sand, and was exceedingly destructive to dredging apparatus. The attempts to use the dredge or the beam trawl were very discouraging. The net was sure to catch upon or under, ragged, projecting rock, and the whole thing would be carried away or the bottom torn out of the net. The most satisfactory work done here was with the tangle, which, though most exasperating to work with, nevertheless always brought up a considerable amount of valuable material, most of which could be saved by exercising unlimited care and patience. Many of our most interesting species of mollusks, crustaceans, and fishes were obtained at these stations, and this region, in spite of the very rough character of the bottom, was our most satisfactory dredging ground.

Hucares.—Some time (February 13 to 16) was devoted to investigations in the vicinity of Hucares. This small place is the port of Naguabo, and is only a few miles up the coast from Playa de Humacao. This coast is afforded some slight protection by Punta Lima and Cayo Santiago, but very little collecting could be done along the shore near Hucares, and still less at the playa, on account of the roughness of the surf. On the lee side of Cayo Santiago fairly good ground was found; but by far the richest collecting in this region was in the little cove just above Point Lima. The surf here was comparatively smooth, the bottom was free from rocks, and fishes and other animals were fairly abundant, both as to individuals and species. A small brackish pool on the shore at this place afforded some additional species, the most interesting of which was the tarpon, of which a number of young individuals were obtained. Three dredging stations (Nos. 6097 to 6099) were made off Hucares, which yielded a good deal of valuable material.

Fajardo.—The last work done by this expedition was off Fajardo, February 16 and 17. This coast is apparently but poorly protected against the northeast trade winds, and during our stay a heavy surf was constantly rolling, precluding the possibility of drawing a seine. It was even difficult to make landings with rowboats.

A short distance off the playa are two little islands, Cayo Obispo and Cayo Sanqudo, about which was excellent collecting-ground. On the lee side many parrot-fishes, chætodonts, and cockeye pilots or mariposas, and one fine specimen of the interesting pipe-fish, *Corythroichthys cayorum*, were obtained. The water here is shallow for a considerable distance from shore, and the bottom is usually smooth and well covered with algæ. On the windward side is a very interesting reef, made up chiefly of masses of dead coral on the shore side; these masses were always well covered on the outside with small crustaceans and univalve mollusks, and by breaking the masses and pulling them apart, which could usually be done quite easily with the hands, many other species were found hidden or lurking in the interstices or in burrows of their own making. Several species of fishes were thus obtained, including some that are new.

This part of the Porto Rican coast was particularly rich in mollusks, a number of species being obtained here that were not seen elsewhere. One interesting bivalve, *Cytherea dione*, seems to be not uncommon here, though it is said not to occur at any other place about Porto Rico.

CHARACTERISTICS OF THE AQUATIC FAUNA OF PORTO RICO.

Certain interesting peculiarities of the aquatic fauna of Porto Rico are directly traceable to the physical characteristics of the shores and environing waters. The shallow, submerged bank from which the island rises borders it very narrowly, and all sides soon drop off into great depths. The 100-fathom line is close to the shore, particularly on the north and south sides. On the north a depth of 3,000 fathoms is soon found, and a little farther out is the "Brownson Deep," with its great depth of 4,561 fathoms. On the Caribbean side also the platform is narrow, a depth of 2,500 fathoms being soon reached. On the east and west ends the platform is continuous in each direction and the depths are frequently less, though by no means inconsiderable, as 700 fathoms has been found at the east and 660 fathoms in Mona Passage. Not only is the border of shallow water about the island very narrow but there are scarcely any banks or shoals. Probably the only ones are in Mona Passage and these are of uncertain depth and location. With the exception of San Juan, Guanica, and Jobos harbors on Porto Rico, and Ensenada Honda on Culebra Island, the entire coast is exposed, not only to frequent storms but to the strength of the trade winds, and for a part at least of every year, or even of every day, there is a heavy surf which beats against the rocky shores or swashes back and forth incessantly on the sandy beaches, holding detached objects, rocks, sticks, or animals at its mercy.

That this rigorous environment has produced certain modifications of form and habit which enable the animals to resist or circumvent the force of the sea is perfectly evident from an examination of the species of any group. The crustaceans, perhaps, have been most interestingly modified, the adaptation taking the direction of an unusual development of hooks and spines upon the legs which enable them to hold on to corals, algæ, or other objects; and the fauna on the exposed coast is remarkable for the great number of species possessing such characters and the almost entire absence of species not so modified. Some species also simulate bits of alga, or actually have algæ growing on their backs, so that when clinging to a mass of coral they are practically indistinguishable. Often have we examined small masses of dead coral and, deciding that it contained nothing, would be on the point of throwing it away, when a small portion of the mass would begin to move and we would discover it to be a small algæ-covered crustacean. Other species of crustaceans maintain themselves by living in the interstices among the rocks or coral, or burrowing into them.

The most characteristic feature of the molluscous fauna was the great preponderance of those species which, such as gasteropods, can cling to rocks, or which either burrow into rocks or live among their interstices. Bivalve shells are rare, excepting those which either live in or burrow into the coral rocks or sand. The species of *Donax*, so common at Mayaguez, is an excellent illustration of this, and *Cytherea dione*, found only at Fajardo, is another. Starfishes and sea-urchins, except those species which live in or under rocks or among the branching corals, are very rare, and such other animals as lie exposed upon the bottom, or which have no special means of maintaining themselves, were poorly represented or entirely absent. The facies of the fish-fauna has been determined in the same way. Brackish-water, free-swimming, shallow-water, and surface-swimming fishes are notably absent, while there are many blennies and gobies living in, under, or among the rocks and in the reefs; gobies, chætodonts, and the like, in the tide-pools or in holes in the rocks along the shore, and scaroids and blennies among the algæ. Among free-swimming fishes as a rule only those species are well represented which live at sufficient depths to prevent their being seriously disturbed by the constant swashing along the shore. In short, all the shore species, not only of fishes but of all other groups, are those which have been able to maintain themselves either by holding to something, by burrowing or crawling into the rocks, by living in protected nooks and corners along the shore, by living in patches of algæ, by burrowing in the sand, or by darting into protected places when the surf becomes too strong.

The peculiar physical conditions described above also account for the scarcity of marine mammals and reptiles, and for the apparent absence of commercial sponges about the island. The only marine mammal known from Porto Rico is the manatee (probably *Trichechus latirostris*), and it is of very rare occurrence, owing no doubt, to the absence of broad sluggish rivers in which it finds its favorite environment. Turtles are also uncommon. The species represented are said to be the hawksbill (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*), which are rare, except at the east end. The scarcity of turtles is doubtless due to the absence of large areas of shallow water with sandy bottom. So far as known, there is no species of alligator, crocodile, or seal about this island.

What has been said of the marine fauna of Porto Rico applies equally well to the inhabitants of the streams of the islands. In the rivers are found more than a dozen species of fishes, most of which are strictly fresh-water species or fishes which run well up fresh-water streams, and with these occur several species of shrimps and prawns. All the rivers of Porto Rico, as already stated, are swift, turbulent streams at all times, and during heavy rains they become veritable torrents, carrying everything caught in the current far out to sea. Fresh-water inhabitants of these streams, in order to escape being swept into an adverse environment in the sea, have acquired the habit of burrowing or going into holes in the banks where they are comparatively safe, even during the greatest of floods. During the evolution of this habit the individuals which tended to seek the holes in the banks most promptly, and to remain in them most persistently, would stand the best chance of surviving, and the result in time has been species that habitually stay in the protected shelters or which do not wander far away.

List of dredging stations of the U. S. Fish Commission steamer Fish Hawk about the island of Porto Rico.

Station No.	Date.	Locality and exact position.a	Depth.	Bottom.	Dredging instruments.
	1899.		*Fathoms.*		
6050	Jan. 13	Off entrance to San Juan Harbor, Old Fort S. ¾ W. 1¼ miles.	91	Sand, mud.....	7-foot beam trawl.
6051	Jan. 13	Off entrance to San Juan Harbor, Old Fort SW. ¾ W. 1¼ miles.	45	.....do.........	Tangle.
6052	Jan. 13	Off entrance to San Juan Harbor, Old Fort SW. ¾ W. 5¼ miles.	310	.....do.........	Dredge.
6053	Jan. 16	San Juan Harbor, NW. angle of Morro Castle ¼ mile...	4 to 7½	Fine sand.....	Do.
6054	Jan. 16	San Juan Harbor, NW. angle of Morro Castle ¾ mile...	4½ to 5½	Sand, mud.....	Dredge and tangle.
6055	Jan. 18	Off Aguadilla, Point de Borinquen light-house NE. by N. ¾ N. 3¼ miles.	137	Sand, mud, and shells.	Dredge.
6056	Jan. 18	Off Aguadilla, Point de Borinquen light-house NE. ¾ E. 3¾ miles.	48	.....do.........	Do.
6057	Jan. 19	Mayaguez Harbor, custom-house E. ¾ N. ¾ mile........	4½	Sticky mud....	Do.
6058	Jan. 19	Mayaguez Harbor, custom-house E. by S. 1½ miles......	7½	.....do.........	7-foot beam trawl.
6059	Jan 19	Mayaguez Harbor, custom-house E. by S. 2 miles.......	7	.....do.........	Do.
6060	Jan. 19	Mayaguez Harbor, custom-house E. by S. ¼ S. 2½ miles....	12	.....do.........	Dredge.
6061	Jan. 20	Mayaguez Harbor, black buoy entrance harbor N. by W. ½ W. ½ mile.	12 to 18	Sand, mud.....	11-foot beam trawl.
6062	Jan. 20	Mayaguez Harbor, red buoy entrance harbor NE. ¾ E. ½ mile,	25 to 30	Sand, mud, and shells.	Dredge.
6063	Jan. 20	Mayaguez Harbor, Punta del Algarrobo E. 2¾ miles.....	75 to 76	Rocky, sand and coral.	11-foot beam trawl.
6064	Jan. 20	Mayaguez Harbor, custom-house E. ¼ N. 4½ miles.......	22 to 33	Sand, mud.....	Dredge.
6065	Jan. 20	Mayaguez Harbor, custom-house NE. ¾ E. 4½ miles.....	4 to 6	Coral..........	Do.
6066	Jan. 20	Mayaguez Harbor, Punta del Algarrobo E. 4½ miles....	161 to 172	Sand, mud.....	11-foot beam trawl.
6067	Jan. 20	Mayaguez Harbor, Punta del Algarrobo E. by N. ¼ N. 5¾ miles.	97 to 120	Coral..........	Dredge.
6068	Jan. 21	Mayaguez Harbor, custom-house ESE. ½ E. 7½ miles....	224 to 237	(?)	9-foot beam trawl.
6069	Jan. 21	Mayaguez Harbor, custom-house ESE. ½ E. 7½ miles....	223 to 231	Sand, mud.....	Dredge.
6070	Jan. 21	Mayaguez Harbor E. ½ S. 9 miles..........................	220 to 225	Rocky.........	9-foot beam trawl.
6071	Jan. 24	Outside of Mayaguez Harbor, custom-house E. ¾ N. 9¼ miles.	192 to 163	.....do.........	Do.
6072	Jan. 25	Off Punta de Melones, Cabo Rojo light-house SSE. 5½ miles.	7½	Coral, sand, shells.	Tangle.
6073	Jan. 25	Off Punta de Melones, Punta Guaniquilla S. by E. 1½ miles.	8	(?)	Dredge.
6074	Jan. 25	Off Puerto Real, Punta Guaniquilla S. ¼ E. 2 miles......	8½	Coral, sand....	Tangle.
6075	Jan. 25	Off Boca Prieta, Punta Guaniquilla SSE. 3½ miles......	8½	.....do.........	
6076	Jan. 26	Off Gallardo Bank, tangent of Morillos de Cabo Rojo ESE. ¾ E. 9½ miles.	10	.....do.........	Do. Do.
6077	Jan. 26	Off Gallardo Bank, tangent of Morillos de Cabo Rojo 12 miles.	10½	.....do.........	Do.
6078	Jan. 26	Off Gallardo Bank, tangent of Morillos de Cabo Rojo 13¾ miles.	11½	.....do.........	Do.
6079	Feb. 6	Off St. Thomas, Sail Rock W. by N. ¼ N. 6 miles........	20 to 23	Coral..........	Do.
6080	Feb. 6	Off St. Thomas, Sail Rock NW. ¼ W. 4 miles............	20	.....do.........	Dredge.
6081	Feb. 6	Between Culebra and St. Thomas, Sail Rock N. by W. ¾ W. 3 miles.	17	.....do.........	Do.
6082	Feb. 6	Between Culebra and St. Thomas, Sail Rock N. 2¾ miles.	18	Rocky and coral.	Tangle.
6083	Feb. 6	Between Vieques and St. Thomas, Sail Rock NE. ¾ N. 7½ miles.	25	(?)	Dredge.
6084	Feb. 8	Off Vieques Island, San Juan light-house NW. ¼ N. 14¾ miles.	11	Coral, sand, shells.	Tangle.
6085	Feb. 8	Off Vieques Island, Point Mula light-house SSW. ¾ W. 5¾ miles.	14	Coral, sand....	7-foot beam trawl.
6086	Feb. 8	Off Culebra Island, Point Mula light-house SW. ¼ S. 8½ miles.	14¾	.....do.........	Dredge.
6087	Feb. 8	Off Culebra Island, Point Mula light-house SW. ¼ S. 10½ miles.	15½	.....do.........	Tangle.
6088	Feb. 8	Off Vieques Island, Sail Rock NE. ¼ N. 10¾ miles.......	23	Coral..........	Do.
6089	Feb. 8	Off Vieques Island, Culebritas light-house N. ¼ E. 7½ miles.	21	.....do.........	Do.
6090	Feb. 8	Off Culebra Island, Culebritas light-house NNE. 5¾ miles	16	.....do.........	Do.
6091	Feb. 8	Off Vieques Island, Culebritas light-house NE. ½ N. 10 miles.	15	.....do.........	Do.
6092	Feb. 8	Off Vieques Island, Culebritas light-house NE. ¾ E. 7½ miles.	16	.....do.........	Do.
6093	Feb. 8	Off Culebra Island, Culebritas light-house NE. 5½ miles.	15	.....do.........	Do.
6094	Feb. 8	Off Vieques Island, tangent of Cabras Island NEE. ¾ E. 10½ miles.	12	.....do.........	Do.
6095	Feb. 8	Off Vieques Island, Point Mula light-house E. by N. 10¾ miles.	12½	.....do.........	Do.
6096	Feb. 8	Off Vieques Island, Point Mula light-house E. ¼ N. 11½ miles.	6	.....do.........	Do.
6097	Feb. 8	Off Humacao, village of Hucares N. ¾ W. 5½ miles......	10	.....do.........	Do.
6098	Feb. 8	Off Humacao, village of Hucares N. ½ W. 3 miles.......	12½	.....do.........	Do.
6099	Feb. 8	Off Humacao, village of Hucares NW. ¾ W. 2½ miles....	9½	.....do.........	Do.

a All compass bearings magnetic.

THE FISHERIES AND FISH TRADE OF PORTO RICO.

BY

WILLIAM A. WILCOX,

Agent of the United States Fish Commission.

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The inquiry concerning the local fisheries and the foreign fishery trade of Porto Rico was made by Mr. W. A. Wilcox. through interviews with the fishermen and others and by visits to the markets of the cities and towns. His report[1] has already been published in the annual report of the Commissioner for 1899. In the preparation of this chapter it has been the aim to summarize and present the more important features of that report and to incorporate some additional information which has more recently been obtained.

Fishing for a livelihood is not carried on to a large extent anywhere in Porto Rico, and scarcely at all for sport. A few fishermen at the several ports make a living by fishing, plantation work, and labor at the docks on vessel cargoes. The professional and semiprofessional fishermen are estimated to number nearly 800, who employ about 350 sail and row boats.

In past years the best of the fishing was monopolized by a few persons who bought the exclusive right to fish at the most favorable localities, near the outlets of streams and at other desirable places along the coast. Rights were advertised and sold at auction by the authorities, who at some ports imposed a special tax on all fresh fish landed. All fisheries were in charge of the captain of the port, any one wishing to engage in the business procuring from him a license and being enrolled in the reserve naval force, licenses being granted only to subjects of Spain. Boats were numbered and a record kept of licenses, men, apparatus, and, to some extent, of the products. Unfortunately for our knowledge of the former extent of the local fishing industry, the records of the captains of the ports were either destroyed or carried away at nearly every port when the change in government took place. Upon the American occupation the granting of exclusive fishing privileges in the waters of Porto Rico and its adjacent islands was abolished by an official order.

The local fisheries may prove to be of considerable value, but time and capital will be needed to develop them. The number of species of good food-fishes occurring about the island is great and many important species are fairly abundant, yet little attention is given to their capture. As a rule, the local markets are indifferently supplied with fresh fish, usually at high prices. Only the few large fish are dressed; none is canned, and the only attention given to curing is when an unusually large catch is made, a few being then poorly cured for the home use of the fishermen. Different methods and more energy in the prosecution of the fisheries are necessary to determine if a large supply can be depended upon. The species best adapted for curing or canning are yet to be ascertained.

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[1] Notes on the Foreign Fishery Trade and Local Fisheries of Porto Rico. (Report U. S. F. C. 1899, pp. 1–34, plates 1–6.)

Cheap ice and quick transportation are two important factors in the fresh-fish business, and at present these are both lacking. Ice is to be procured at very few places, and the price, $12 to $15 a ton, is too high for its use in the fisheries. The few short lines of railroad have no express business, and no fresh fish are transported by rail. With few exceptions the common roads are so poor that merchandise has to be carried by pack animals. Only those persons living near the seacoast or some of the rivers ever have fresh fish. With improved transporting facilities and cheaper ice, the thickly settled interior could receive a more abundant supply of fresh fish at more reasonable prices, to the benefit of both consumers and dealers.

The entire absence of machine-made nets is to be noted. With the introduction of capital and the development of the fisheries, there would at once come a large demand for these goods. The few nets now used are handmade by the poor fishermen, who are seldom able to buy more than a few balls of twine at a time.

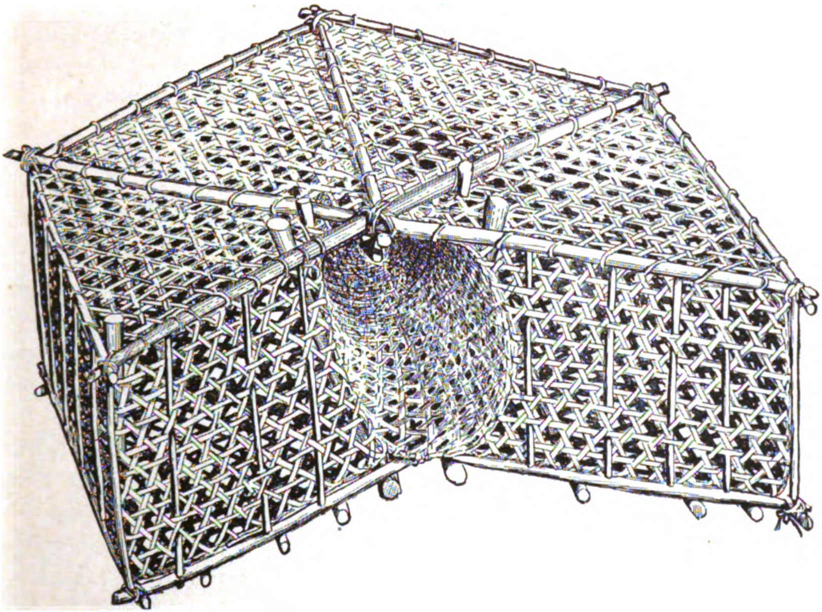
The change in the government of Porto Rico has been so recent that it will be some time before the old methods will become modified to suit the new conditions. In supplying the island with the large amount of cured fish required annually, there will be changes by shippers and receivers in methods of handling, one of importance being a change from the long-time credit system. A knowledge of the coffee and sugar industries of the island is important to shippers, as return cargoes often have to be secured. The future imports of fishery products may reasonably be expected to come from sources that can lay them down at the lowest prices, and to some extent handle in return the products of the island.

As the Porto Ricans are conservative and slow to experiment with unfamiliar articles, some time will be required to introduce boneless or other fish preparations unknown to them. They are quick to appreciate low prices, and when they learn the good qualities of boneless fish, canned fish, and similar foods prepared in the United States, a large demand for good articles, at reasonably low prices, may be expected.

APPARATUS AND METHODS.

The methods of the Porto Rican fishermen are rather crude, and the boats and other apparatus are usually of poor construction. The majority of the boats are flat-bottomed, though some have keels. Some are of schooner, sloop, and cat rig, and there are some skiffs and dories with sails. The lateen sail is in general use. Only at Mayaguez and Puerto Real did any of the boats have live-wells in which to keep the fish. The fishing tackle consists of pots or traps, haul seines, gill nets, cast nets, and hand lines.

The fish pots or traps, or basket traps, as they are variously called, are of simple construction, and are worth from $4 to $10. The frame is of mangrove or other wood and the body of split wild cane, wood, or bark, woven in 2-inch, 6-sided meshes. The body and frame are fastened together with calabash roots, which are very strong and, when water-soaked, very pliable. The mouth of the pot is on the side with the reentrant angle, the entrance narrowing as it passes with a curve into the pot; a small door in the back permits the removal of the catch. The size of the pot varies in different parts of the island, the largest seen being 6 feet long, 3 feet wide, and 18 inches deep, while others were only about half as large. It seems to be the usual custom not to bait the pot in any way, the fishermen trusting to curiosity to lead some fish in and serve as decoys to others. At Culebra Island, however, the negroes from the British and Danish West Indies, particularly from Tortola, baited their pots with large chunks of cactus, from which they had trimmed off the green outside, exposing the white pulp. These white objects in the trap serve as decoys. At Palo Seco burned bones, hoofs of cattle, and sour or decayed oranges were used. The pots are set at depths varying perhaps from 3 or 4 fathoms up to 30 or 40 fathoms, with stones or other weights to anchor them, their location being marked by one or more buoys which are fastened to them by means of a rope or long cable of plaited bark or pliable strips of wood. The pots are usually lifted daily.



Bamboo Fish Pot or Trap in general use in Porto Rico.

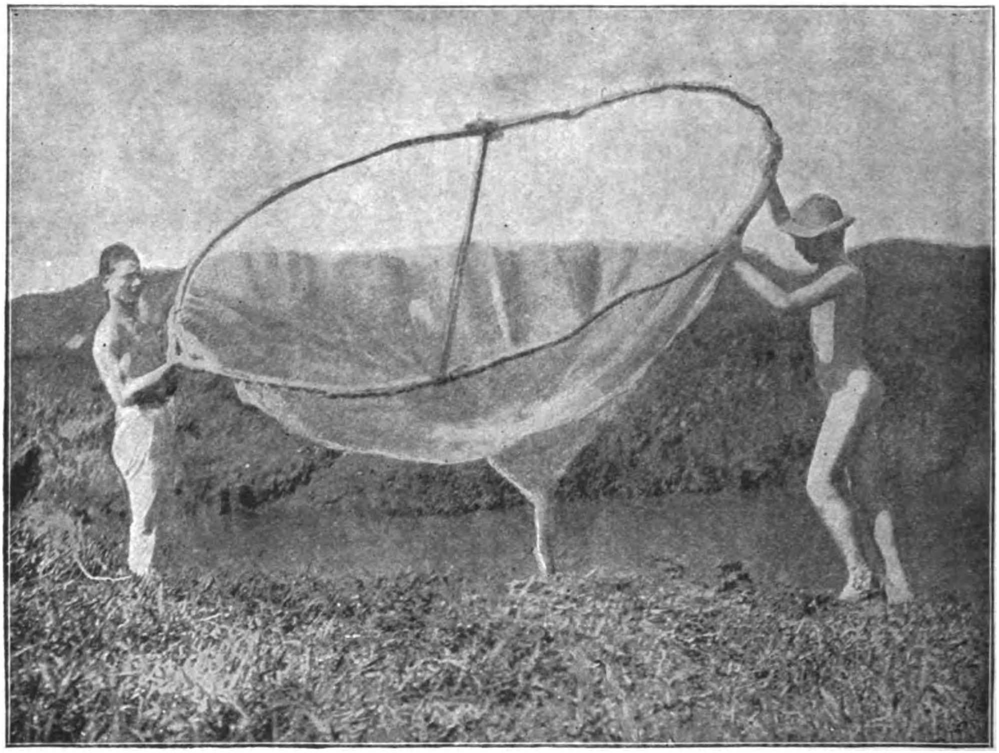
Haul seines are not extensively used, the character of the shore making their operation difficult and unsatisfactory. About 10 are in use at Aguadilla and from 1 to 2 or 3 at a few other places. They are usually from 150 to 300 feet long and from 15 to 20 feet deep, and with 3 and 1¼ inches mesh in the wings and ¾ inch in the bunt. These seines cost about $50, of which half is allowed for twine and half for leads, corks, and labor, the nets being made by the fishermen themselves.

Gill nets are even less commonly used, and were seen only at Palo Seco, where they are drifted with the tide, either in the bay or the mouth of the Bayamon River. They were about 600 feet long, 12 feet deep, and with 2-inch mesh, bar measure.

Cast nets are in common use in many places about the island. They are funnel-shaped, the large end being 6 to 10 feet wide, tapering off through its 6 to 8 feet of depth to a point to which a line is attached; the netting is 1-inch-stretch mesh, with the bottom leaded. If properly thrown, they spread wide open before striking the water, and in this position sink to the bottom, after which they are immediately drawn in and the catch removed. The value of a cast net is $3 to $5. They are used along the shore in the surf for sardines and in the river mouths for mullets.

Hoop nets are used to some extent in river mouths. They are funnel-shaped, 6 feet in depth, of 1-inch-stretch mesh, and the mouth is stretched on a 6 by 4 foot hoop of *poma rosa* wood. They were seen only in the Bayamon River, where they are used at holes or indentations in the banks, against which they are placed and the fish frightened into the net.

Fish weirs or traps are used in the Bayamon River by building a hedge of canes across the stream, with a gateway for passing boats. The hedge is made with pockets at various places on each side, and the fish, in going up or down stream, enter these pockets and are removed with dip nets. In some streams the hedges have no pockets, but funnels of bamboo or cane splints are inserted at various places. Fish seeking a passage through the hedge enter these cones and become wedged, few escaping.



Natives with Hoop Nets, Bayamon River.

Trawl lines are used to some extent, chiefly at Aguadilla and Mayaguez, generally where the water is several fathoms deep, and 3 to 10 miles offshore. Each trawl has from 75 to 200 hooks fastened singly to snoods 3 feet long and placed 6 feet apart. The trawls are baited with sardines and are anchored. For deep-water fishing, from 3 to 4 miles offshore, in water from 60 to 500 feet deep, the bow rig is employed, chiefly at Aguadilla and Arecibo. This is simply a bow of strong wire, at each end of which is attached a short line, having from 1 to 6 hooks; its value is about $3. The principal species taken with this apparatus is said to be the "cabrilla" or "red-hind," *Epinephelus guttatus*. Trolling lines are used to some extent, chiefly at San Juan, Aguadilla, and Mayaguez. Each line has a single hook, baited with sardines, and fish of large size are usually taken.

THE LOCAL FISHERIES.

San Juan.—The fisheries here scarcely receive the attention which would be expected from a city of the size of San Juan. There are 75 fishermen, using 4 keel and 25 flat-bottom, lateen-rigged boats of small size and little value. These men work on the neighboring plantations more or less, only a few of them being engaged in fishing at any one time. The apparatus consists of fish pots, seines, and chinchorros. Nearly all the species seen in the San Juan market, except the "colorado" and the "sierra," are taken in the pots. The seine is used chiefly for "liza" and "robalo," and the chinchorro or round seine for corcobados, sables, balaju, corvina, and corjinua. In the gill nets are caught the pargo, jurel, barbudo, chopa, and corvina. The cast net is used almost exclusively for sardines. The silgo or trolling line is used chiefly for the sierra (*Scomberomorus maculatus*). The colorado (*Neomænis vivanus*), one of the most important fishes of the San Juan market, is taken only by the hand line, usually in about 60 fathoms of water. The fishermen use very small boats, and can go out only when the sea and wind are quiet. The fishing is done very early in the morning.

Almost every part of the harbor of San Juan supplies some fish to the market. Just off Cataño, near the Marina, are two of the principal places where the fish pots are used, obtaining great numbers of pargo, cherna, muniama, ronco, chopa, moharra, and corvina. At the Playa de la Mosa and at Palo Seco seines take large numbers of liza, jarea, and robalo. The ground off Morro Castle supplies about all the colorados (*Neomænis vivanus*) brought to San Juan. Another principal fishing-ground supplying San Juan is 4 or 5 miles eastward of the city, near Cangrejos and San Jose. The fishermen using that ground leave San Juan early in the morning, spend the day and following night fishing, and return to San Juan to market their catch on the morning of the second day by 5 to 7 o'clock.

Palo Seco is the principal fishing village supplying the San Juan market. There are here about 60 fishermen, who use 25 small sail and row boats with fishing appliances similar to those already noted. Their catch is chiefly made in the evening and at night, in and near the mouth of the river and in the bay, a few boats using trolling lines outside of the harbor. Fish pots are set in the river and bay and outside of the harbor. When used in the river they are attached to the shore by a line; when used outside they are weighted with stones and anchored to a buoy, although when well water-soaked they need no weights.

The anglers, or those who go fishing for sport, usually fish for the sierra, the jurel, and the cherna, and those who go outside get the colorado. Probably the best angling about San Juan is between the Marina and Morro Castle and at Pueblo Viejo. Jurel and cherna are often taken on hand lines at the foot of San Cristobal. Anglers also make trips to the Rio Plata for robalos.

The number of species of food-fishes seen in the San Juan market is quite large and compares very favorably with that of any of our cities. About 40 species were seen there by us during our brief stay in January, and to these Mr. Oscar Riddle has been able to add several during his inspection at various times during the winter and spring of 1900. In the following list are included 50 species commonly seen in the San Juan market, arranged approximately in the order of their importance. The common names given are those most frequently used in this market, and the prices per pound are in American money.

List of food-fishes seen in the San Juan market.

Scientific name.	Common name.	Price per pound.	Scientific name.	Common name.	Price per pound.
		Cents.			*Cents.*
1. Mugil brasiliensis	Liza	9	26. Tylosurus raphidoma	Balaju	3
2. Mugil curema	do	9	27. Hyporhampus unifasciatus	do	3
3. Neomænis synagris	Pargo	7	28. Archosargus unimaculatus	Chopa amarilla	3
4. Neomænis analis	do	7	29. Chloroscombrus chrysurus	Casabe	3
5. Neomænis griseus	Pargo colorado	7	30. Oligoplites saurus	Zapatero	3
6. Neomænis vivanus	Colorado	12	31. Holocentrus ascensionis	Candil	6
7. Centropomus undecimalis	Robalo	9	32. Agonostomus monticola	Dajao	6
8. Opisthonema oglinum	Sardina	2.5	33. Auxis thazard	Albacoro	6
9. Gerres brasilianus	Moharra	6	34. Sphyræna barracuda	Picuda	7
10. Gerres rhombeus	do	6	35. Pseudoscarus guacamaia	Loro	3
11. Eucinostomus harengulus	do	6	36. Trichiurus lepturus	Sable	3
12. Cynoscion jamaicensis	Corvina	6	37. Caranx bartholomæi	Corjinua	6
13. Epinephelus striatus	Cherna	7	38. Caranx crysos	do	6
14. Alphestes chloropterus	do	7	39. Peprilus paru	Palometa	6
15. Xystæma cinereum	Muniama	3	40. Conodon nobilis	Bureteado	5
16. Trachinotus glaucus	Pompano	7	41. Teuthis bahianus	Barbero	3
17. Scomberomorus maculatus	Sierra	7	42. Teuthis hepatus	do	3
18. Polydactylus virginicus	Barbudo	6	43. Scorpæna plumieri	Rascacio	2.5
19. Hæmulon sciurus	Ronco amarillo	6	44. Priacanthus cruentatus	Ojon	2.5
20. Pomadasis ramosus	Ronco blanco	6	45. Pomacanthus paru	Marequita	6
21. Lobotes surinamensis	Capitan	7	46. Larimus breviceps	Cabeson	6
22. Philypnus dormitor	Guavina	6	17. Guavina guavina	Moron	
23. Anguilla chrysypa	Anguilla	7	48. Albula vulpes	Macabi	5
24. Caranx latus	Jurel	6	49. Elops saurus	Piojo	3
25. Vomer gabonensis	Corcobado	8	50. Spheroides testudineus	Tamboril	2

Bayamon.—Bayamon is supplied with fresh fish taken from the river by six resident fishermen, and by others who live along the river banks to the north and south who give only a part of their time to fishing. They use hoop nets, cast nets, gill nets, haul seines, and a few fish pots.

Arecibo.—From 40 to 50 men at this port follow fishing for a living at all seasons of the year when the weather permits. The grounds are along the beach at the city front, and 3 to 4 miles out, and in the nearby waters of the Rio Grande de Arecibo. Twelve to 15 small boats with lateen sails are in use. They are built at Arecibo and are expensive, a small, open-keel boat bringing $100 to $150, and the common flat-bottom skiffs $30 to $50, in Spanish money.

A large portion of the catch is made by 2 haul seines, each 360 feet long by 12 feet deep, 12 to 14 men being required to haul one through the swells and surf of the beach. The bow rig, with from 3 to 6 hooks attached to each of the short snoods suspended from its end, is used from 3 to 4 miles from shore, in from 60 to 150 fathoms of water. They are employed on 6 or 8 of the largest boats, carrying from 3 to 4 men each. About 40 cast nets are used along the beach and in the river, taking sardines and other small fish. In the last 16 miles of its course the Rio Grande de Arecibo is fished more or less throughout the year with cast nets and occasionally with haul seines at its mouth.

No fish are cured, all being sold fresh to the consumer by the fishermen, who carry them suspended on poles, selling small fish by the bunch and those of large size by the piece. A market is found in Arecibo and at the surrounding plantations.

Aguadilla.—This is the only port in which the old Spanish system of keeping a record of the fisheries is yet in vogue. For many years records were kept by the former captain of the port, who continues to record the number of fishermen, their apparatus, and approximate catch. He reports 40 boats and 100 fishermen, and places their aggregate catch during the past year at 80,000 pounds. Fresh fish forms a large portion of the food of the 5,000 inhabitants of this city and vicinity. The catch is mainly made in the waters of the bay, some small fish being taken with cast nets from the Culebrinas River, which is fished from its mouth for 2 miles upstream. Fishing is chiefly in the early morning, with considerable toward the close of the day, and very little between morning and late afternoon.

The boats are flat-bottomed dories, similar to those in general use in New England; they are 12 to 18 feet long, 3 feet beam, with sides of imported pine and frame of native wood. They are made at the port and are valued at $25 each.

Fishing in the bay is largely by 10 haul seines used along the beach. Each is from 150 to 300 feet in length by 15 to 20 feet in depth, with mesh 3 and 1¼ inches in the wings and ¾ inch in the bunt. They are hauled by 6 or 8 men to a net. There are 10 trawl lines used in from 50 to 100 feet of water, having from 100 to 200 hooks, each attached to short snoods. For deep-water fishing, from 3 to 4 miles off shore, 50 bow rigs are used in water from 300 to 500 feet deep. Sixty cast nets, having ½ inch square mesh and valued at $4 each, are in use. Forty traps or pots are used in the bay, and at times a small number are fished in the river. They are made of woven bamboo splints fastened to light frames, each 3 feet in diameter and somewhat smaller than those used at other places. They are valued at $4 each, and in bay fishing are anchored in 40 feet of water.

The annals regarding the first landing-place of Columbus in Porto Rico recite that it took place in "a small bay abundantly supplied with fish." Popular tradition in the island is that the "small bay" referred to in the ancient documents was that of the present city of Aguadilla, or rather a little to the south of Aguadilla, in the municipal district of Aguada, and in 1893 a Latin cross, known generally as the "Columbus cross," was erected to mark the spot.

Mayaguez.—The fresh-fish business of this port is not extensive, but the market has a larger supply and better variety of fish than are found at the markets of San Juan and Ponce. The catch is made by 25 fishermen, who use 10 to 12 small sloop-rigged keel boats, built at the port at a cost of from $50 to $175 each. Most of the boats have a well in the center to keep the fish alive. An equal number of dories are used, which are of Canadian or United States make, having been purchased of vessels arriving with dry fish.

The fishing-grounds for haul seines and cast nets are along the beach near the city landing; in the harbor and open sea, to a distance of 8 to 10 miles, hooks and lines and set pots are employed. Wicker pots or traps are anchored in from 18 to 25 fathoms of water. Six boats, with from 12 to 25 pots each, are used near the landing and as far out as 10 miles.

Fourteen cast nets, worth 5 to 8 pesos each, are fished along the beach for sardines and other small fish.

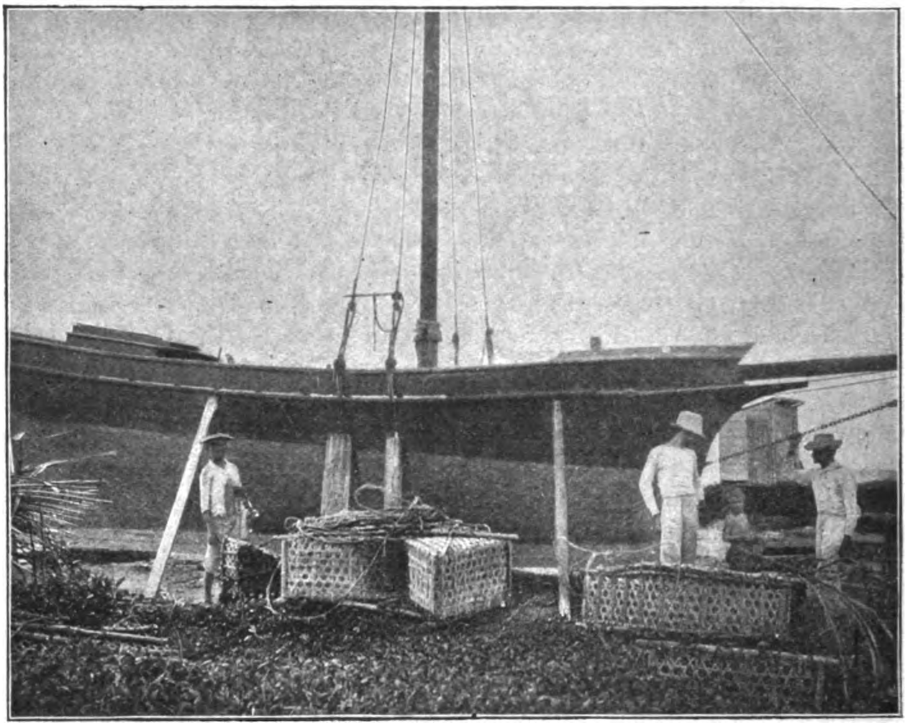
Three trawls are fished by six men in three boats, in from 8 to 100 fathoms of water, some 8 to 10 miles west from the city landing of Mayaguez. From 75 to 200 hooks are used to each trawl, and these are fastened to snoods 3 feet long and 1 fathom apart, with 1 hook on each. Trawls are baited with sardines and anchored. They are often underrun, and are taken up as soon as a sufficient catch has been made or the time has arrived for a return to market. The trawls are worth $3 to $5 each.

Trolling lines are used to some extent, with single hook baited with sardines. The hooks used are Nos. 1 to 9. Twine for trawls is worth 25 cents per pound.

The catch is sold by peddlers, who buy the fish or are hired by the fishermen, and to fish-stands in the large market of the city. The fishermen receive an average of 6 cents a pound, the consumer paying about 10. All fish are sold undressed, at so much a bunch for those of small size. Large fish are cut into strips and sold by the piece. Commercial fishes are said to be most abundant in the harbor of Mayaguez from August to December, but are abundant outside at all seasons.

Spiny lobsters, weighing from 2 to 10 pounds each, are found at all seasons, but mostly during April and May.

Algarrobo, a small fishing settlement in the suburbs of Mayaguez, has 14 fishermen, who use 4 dories and 1 sloop. This sloop, the *Francisca*, was built at Algarrobo at a cost of $1,200, Spanish money. It measures 7½ tons and is the only vessel used in the fisheries of the island that is of sufficient tonnage to require registry at the custom-house. It was built soon after the close of the late war and had made but three short trips up to the last of January, 1899. It is 30 feet long, 9½ feet beam, with 5 feet depth of hold. In the center is a well 7 feet long, with 31 1½-inch holes on each side, to admit the water. Aft of the well is a small compartment for sleeping quarters, and forward is a small galley for cooking. Her fishing gear consists of 40 set pots, by which most of the catch is made, a small trawl with 100 hooks being used occasionally. The catch is made along the coast, the sloop going as far as off Mona Island, 42 miles distant. Sardines are used for bait on the trawl, the pots generally being set without bait.



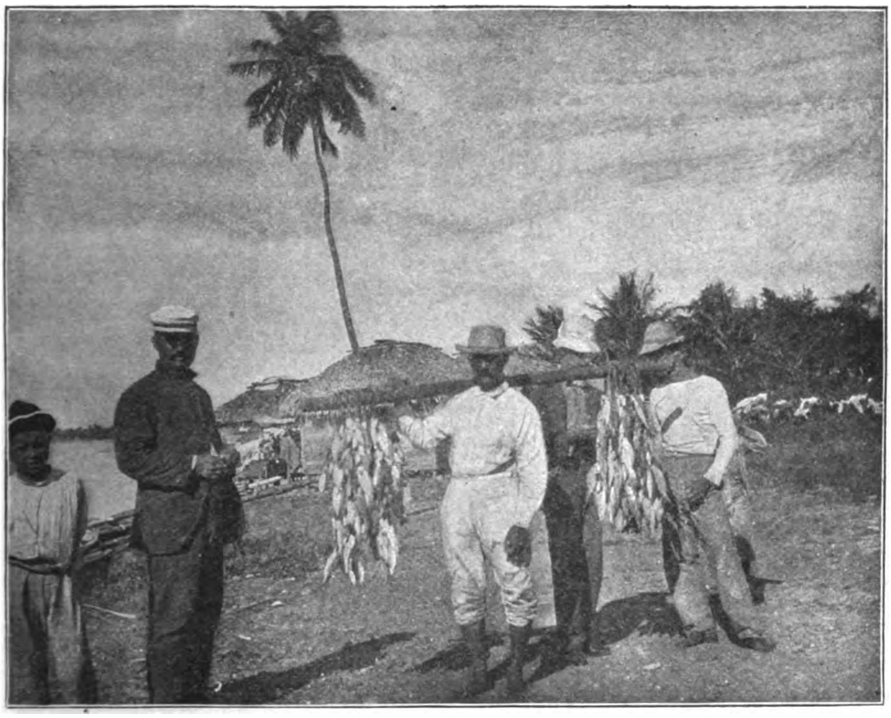
Fishing Schooner Francisca and Wicker Fishing Pots.

At *Sabanita*, a few miles north of Algarrobo, from 30 to 40 men carry on more or less fishing, using 2 boats in seining, 5 in fishing pots, and 6 in trawl fishing.

Other small fishing-places in the vicinity of Mayaguez are Añasco, Arribo, and Corega, each with a few men who fish in the vicinity of their homes. The catch is sold to the neighboring villages and plantations, and the fish-market of Mayaguez is better supplied than that of any other place on the island. Fish are peddled along the route to the city, being suspended from poles carried on the shoulders.

No fish are cured and any surplus is thrown away.

Puerto Real.—This village of 250 inhabitants, near the southwestern end of Porto Rico, is the landing-place for Cabo Rojo, which formerly had a second-grade custom-house, permitting exports but no imports. A small amount of fishing is carried on by 25 men. Their apparatus consists of haul seines, pots, and single hooks and lines. The catch is kept alive, either in the well of the boat or in cars anchored off the landing, until disposed of in the vicinity or taken to Mayaguez.



Fish-peddlers at Puerto Real.

Ponce.—In view of the large imports of dry and pickled fish and its general use by the inhabitants of this city, and the number of so-called fishermen of the place, the amount of its fresh-fish business is surprisingly small. The captain of the port reports that since the late change in government 127 men have been enrolled and granted permission to fish, free of any charge, in the waters of the district. They use 60 small, open boats of schooner, sloop, and cat rig, together with skiffs and dories with sails. None of them is large enough to be entered at the custom-house or to need any papers except that granting the privilege of fishing. The catch is made chiefly with set pots anchored in and about the harbor; single hooks and lines are used, and a few haul seines are operated along the water front.

There is said to be a scarcity of fish in this vicinity. So long as the fishing is done with set pots, in which bait is seldom used, only light catches of small and medium fish can be expected. A few large fish are taken by men with a single hook and line in deep water.

No fish are dried, smoked, pickled, or canned, all being disposed of fresh for local use. The aggregate catch is small, and no record is kept of the amount.

The city has quite a large and good general market, in which the fresh-fish business makes a poor showing, with its one stand, on which a few fish are sold by two or three men. Fish are peddled through the streets, the small fish at so much a bunch, those weighing 2 to 6 or 8 pounds at so much each; none is sold by weight; none is dressed, and ice is not used. Retail prices average 10 to 15 cents a pound in Spanish money, or 6 to 9 cents a pound in United States money.

The records in the custom-house show that during the portion of 1898 in which Ponce was under Spanish rule the fishing business of the district was represented by 340 fishermen, with 109 registered boats. This district then included most of the south side and a small portion of the west end of the island, or about one-third of the coast line of Porto Rico. That the business was carried on with little energy or return to the fishermen may also be judged by the records for the last six months of Spanish rule, which show that the aggregate value of fish taken in the district during that period amounted to only 26,815 pesetas, representing $3,218 in United States money. On account of the disturbed condition of all Porto Rican business in 1898 that year can not be considered as a fair average.

Arroyo.—From 30 to 60 men engage more or less in fishing at this place, with haul seines, cast nets, and pots, the larger part of the catch being taken in pots, and chiefly from May to August; during the remainder of the year most of the fishermen work on plantations. They make their own boats, which are roughly built, but very strong, without decks or wells, and 15 feet long by 6 to 7 feet beam. Thirty-five boats are in use, with an average value of $50; 2 men go in each.

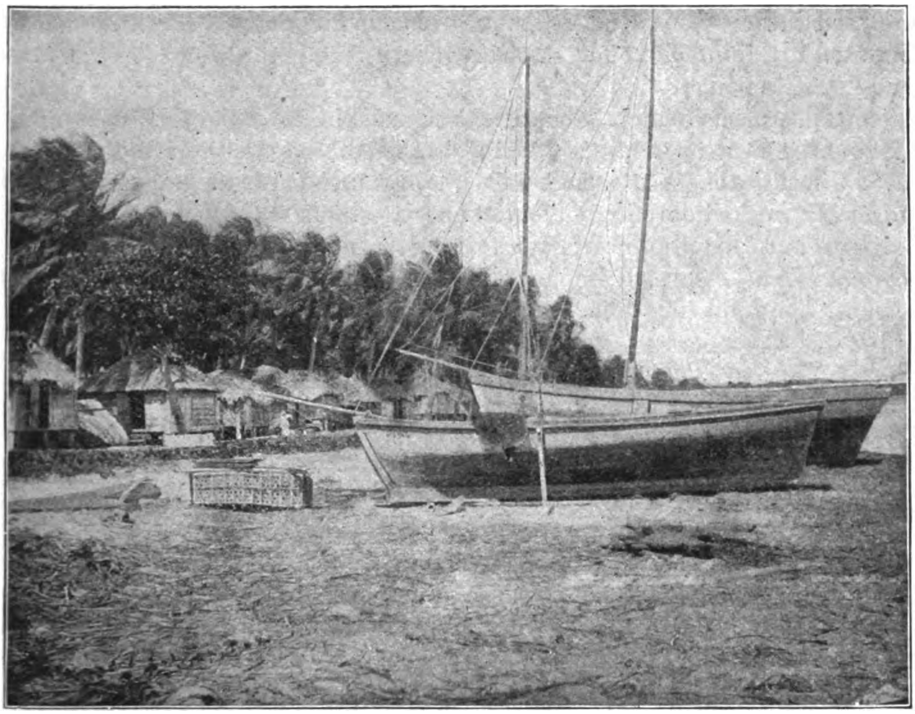
A few haul seines are employed. The largest are 200 feet long and 10 to 15 feet deep, with a bag net in the center; the mesh is 1½ inches (square) in the wings and 1 inch in the bag. There are 6 small seines, each 120 feet long, with ½-inch (square) mesh, and are without any bag attachment. Small seines are chiefly for taking bait for hook-and-line fishing. Six cast nets are employed along the shore. Six trawls are operated, having from 50 to 200 hooks each, with snoods 2 feet long and placed 4 feet apart. The buoy to the trawl is said to have a bell attached by which the fishermen judge as to the best time to take it up. Trawls are generally fished during the night. Sharks are numerous and often destroy an entire trawl outfit.

Fish pots are used in from 20 to 25 fathoms of water, and are lifted once a day in removing the fish. They are of larger size than at most places, being 6 feet long, 3 feet wide, and 18 inches deep.

The Patillas River, a small stream having its outlet a few miles east of Arroyo, is said to be well supplied with fish, which are taken by weirs, haul seines, and cast nets.

The fresh and salt water fish taken in the vicinity of Arroyo are sold fresh from a few rough tables near the water front, or peddled through the country by men on foot and on horseback. As a rule prices are high to the consumers, ranging from 7 to 12 cents a pound for undressed fish. Imported dry fish are often cheaper than fresh fish and much more in demand.

Punta Santiago.—This place is of some importance as a receiving and distributing point for the rich and thickly settled district of Humacao. The port has about 1,000 inhabitants, a custom-house, and a few stores. The town of Humacao is 4 miles inland. Large quantities of dried and fresh fish are consumed in the district, the former being received from Ponce and San Juan. Customs records show no direct imports of fish during the past five years.



Fishing Boats and Fishermen's Homes, Punta Santiago.

During April, May, and June trolling lines are much used, but at other seasons trolling is done only when going to and returning from the pots. The principal part of the catch is from pots, sometimes baited with fragments of crawfish or spiny lobsters, but as a rule pots are not baited. Crawfish are plentiful and at times the pots will be filled with them; when more are taken than can be disposed of the surplus is returned to the sea. They are sold at an average of 3 cents a pound, the largest weighing 6 to 8 pounds. When the pots are baited with broken-up crawfish the catch is confined to fish, as no crawfish will then enter them.

The fish are sold fresh, undressed, supplying the local demand only. The fishermen receive 4 to 6 cents a pound; they occasionally dry a small amount of fish for their own use.

Hucares.—This place is 4 miles north of Punta Santiago. Near the shore the water is shallow, necessitating the lighterage of cargoes. Fish are reported plentiful in the harbor, where they are taken by 10 fishermen, using 4 boats, 60 pots, and several trolling lines; the principal catch, however, is in pots.

Fajardo.—Fajardo, with a population of 4,000, is the most important place at the northeastern end of the island, and is located 2 miles inland from the *playa* or landing. At the latter there are 600 inhabitants, a few small stores, and the customhouse, which, prior to the change of government, was a second-grade office at which no imports were permitted. A large amount of dry and fresh fish is consumed.

Eighty men are here engaged in fishing with apparatus and boats valued at about $4,000. Fishing is chiefly by set pots; occasionally a few haul seines and cast nets are used in the general fishery, and gill nets for turtles. Trolling hooks and lines are used to a limited extent. Fish are plentiful and are all sold fresh, undressed, at about 4 cents a pound.

At certain seasons a light catch of fish is made in the Fajardo River, a few cast nets being used near its mouth. Within 6 miles of the mouth of the river 3 weirs have been fished in the past. The best fishing-grounds, near the mouth of the river, were formerly worked only by holders of special grants from the government.

At Ceiba and Luquillo, near Fajardo, some fishing is done.

Vieques Island.—A small amount of fishing is carried on at several places about this island. The following table gives all the statistics obtainable:

Location.	Men.	Boats.	Pots.
Puerto Isabel Segunda	12	6	50
Puerto Real	4	2	12
Puerto Negro	2	1	8
Puerto Arenas	6	3	18
Puerto Mosquito	6	3	20
Total	30	15	108

Trolling lines and a few nets are used, but most of the fishing is by set pots, anchored by ropes made of vines. The catch is peddled through the several small villages and at the plantations, selling at 5 cents a pound. A few turtles are taken at the southern end of the island. Small vessels from the neighboring British and Danish islands sometimes visit this section for turtles. Besides the 50 pots at Isabel Segunda there are 25 cast nets and 1 haul seine 150 feet long and 10 feet deep.

Culebra Island.—Fish are abundant about this island, but very little attention is given fishing by the inhabitants, only two or three men being engaged. Imported dry cod is much more used than fresh fish. The neighborhood is visited by a number of fishermen from the British and Danish West Indies, particularly from Tortola, St. Thomas, and Santa Cruz, who fish chiefly with pots. Between April and September trolling lines are used, chiefly for king-fish, which are said to weigh from 20 to 30 pounds on the average, some being much heavier. Among the other fish taken in trolling are the capitan and barracuda. Trolling is done between sunrise and 8 or 9 in the morning.

About Vieques and Culebra islands and the east end of Porto Rico as far west as Arroyo is the region where turtle fishing is carried on to the greatest extent. At

Arroyo turtles are found at all seasons, being most plentiful from September to the last of December, during which time they deposit their eggs in the sand of the beach. In the latter part of November, 1898, this section was fished by two small vessels from the English island of Tortola, who used large-mesh nets to which wooden decoy turtles were attached, the nets being set near the coral reefs off the harbor of Arroyo. The vessels remained two weeks and it was reported that a fair catch was made.

A few turtles are caught about the small islands near Hucares, chiefly with gill nets. During 1898, 400 pounds of hawksbill turtle shells were taken and sent to New York, where the best brought $5 a pound in gold. The nets used about Vieques and Culebra islands are 27 feet long, 8 to 12 feet deep, and of 12-inch square mesh. A few turtles are taken on the beaches, but the catch is principally by nets, which, with their wooden decoy turtles, are anchored near the coral reefs; the nets are visited once or twice a day during the turtle-fishing season, which is said to be in May, June, July, and August.

The hawksbill, green sea, and loggerhead turtles are reported more plentiful in this vicinity than elsewhere about Porto Rico. The catch, however, is small, only 75 hawksbill turtles having been taken in 1898. The shell of the hawksbill is said to average from 3 to 5 pounds, and brings from 75 cents to $4 a pound in gold at St. Thomas. The loggerhead turtle is used only for its oil. The meat of the other species is sold for food at 6 cents a pound.

FISHERY PRODUCTS IMPORTED BY PORTO RICO.

The population of Porto Rico on October 16, 1899, according to the census taken by the United States Government, was 953,243. That fishery products form an important portion of the food supply of the island is shown by the importation, in 1897, of about 33,449,422 pounds of dried, pickled, canned, and other fish, valued at $2,123,931. The total imports for the year furnished for each inhabitant an average of 35 pounds of fish. The value of imported fishery products, with the duty paid on the same during the five years named, was as follows:

Year.	Value.	Duty.
1893	$1,325,073.52	$87,677.16
1894	1,649,601.42	94,834.50
1895	1,987,676.56	122,087.99
1896	1,815,010.89	117,497.21
1897	2,123,931.46	139,661.35

With the exception of occasional small shipments, principally of canned fish, to grocers, this large amount of imported fish is handled by a comparatively small number of commission merchants, whose principal business is in sugar and coffee. In some cases the merchants own and work plantations, and all of them make large advances on crops which they dispose of by direct sales or as forwarding agents, thus providing return cargoes to vessels arriving with fish. A number of firms have branch houses at the three leading ports of Ponce, San Juan, and Mayaguez, where they have long been established. The old leading firms have a high rating for integrity and financial standing.

The manner of receiving and handling fish is similar at all ports, with some variations due to port charges, different climatic conditions, etc.

Dry and pickled fish are received more or less regularly throughout the year, mostly from Halifax and Lunenburg, Nova Scotia. A few cargoes arrive from Yarmouth, Nova Scotia, and occasionally a cargo comes from St. Johns, Newfoundland. The total receipts of dry and pickled fish in 1897 amounted to 33,449,422 pounds, from the following localities:

	Pounds.
North American British Possessions	28,048,735
United States	4,909,141
All other sections	491,546

This amount approximated 85 per cent of dry fish and 15 per cent of pickled fish, the proportions of dry fish by species being 90 per cent cod, 7 per cent haddock, and 3 per cent hake. The proportion of a cargo of 2,000 quintals would be about as follows: 425 tierces, 100 to 150 drums, 100 boxes, 100 half-boxes. Tierces contain 450 pounds net, drums 125 to 140 pounds, boxes 100 pounds, half-boxes 50 pounds.

The climate of Porto Rico, with its months of warm, damp weather and much rain, is very trying on dry fish. If not properly cured they will soon turn red or become soft and otherwise unmarketable. Fish from the United States would probably have to be cured harder than is customary for home or northern demand. They should be well but not too heavily salted, and well dried. Small-sized cod that will pack in tierces and drums without bending are preferred to large fish, except for the small amount packed in boxes, these being for the local city trade, in which large fish are desirable. December, January, February, and March are the best months for keeping fish in good condition in Porto Rico. The largest demand is in January, February, March, and April.

In past years consumers of dry and pickled fish in Porto Rico have apparently been more concerned as to prices than quality, much inferior fish being consequently sent to this island. Natives often buy fish, if of low price, that would not be used in the United States. Occasionally fish are condemned and destroyed by the city officials. The present indications point to a demand for a better quality of goods.

Pickled fish are not much used. Split herring are preferred to round, on account of keeping better, and bring $1 a barrel more. Alewives are not desired and are seldom received. Mackerel are too high-priced to have an extensive sale, the few received being usually of small size on account of being cheaper. Smoked-herring receipts are light, and comprise both "scaled" and "lengthwise" fish. Boneless fish are almost unknown; their introduction would be slow at first, and only small initial shipments would be advised.

The total value of canned fish imported into Porto Rico in 1897 was only $151,408. High prices and duties may account for this small amount, which consisted chiefly of sardines from Spain, receipts from that country having been free of duty, except when shipped under a foreign flag, which was seldom. If canned fish could be furnished at a low price, their sale would no doubt largely increase as their good qualities became more fully understood.

Imported fishery products may be considered by ports, as follows:

San Juan.—The capital city of the island has a population of 32,048. Its imports of fishery products are exceeded only by those of Ponce. In 1897 the canned fish imported amounted in value to $112,091, of which only $806 worth came from the United States. Boneless fish are occasionally received in small amounts by retail grocers. The receipts of dry and pickled fish in 1897 were as follows:

From—	Kilograms.	Pounds.	Value.
British North America	3,380,410	7,452,524	$439,453
United States	268,729	592,446	34,935
Other sources	147,901	326,065	19,227
Total	3,797,040	8,371,035	493,615

Ponce.—The population of Ponce is 27,952. In the matter of fish imports this is by far the most important place in Porto Rico. The receipts for 1897 are said to be a fair average of the imports of late years, and amounted in value to $1,016,447 on dry and pickled fish, and $14,406 on canned fish.

The value of dry and pickled fish received in 1897 was as follows:

From British North American Possessions	$771,303.52
United States	234,972.50
All others	10,171.17
Total	1,016,447.19

Imported dry fish consists principally of cod-fish. Hake and haddock are said to stand the climate better than cod, but only a small amount can be disposed of. Poor cod-fish is preferred to hake and haddock of much better condition and lower price. Of pickled fish, a few herring are used, but seldom any alewives. Split herring bring $1 a barrel more than round. Smoked herring are only used to a limited extent, "lengthwise" being preferred.

Canned fish are little used, the amount imported in 1897 being valued as follows:

From England	$8,215
Spain	5,808
United States	166
France	184
Italy	33
Total	14,406

Imported fish are usually distributed to the interior in original packages, but when goods are to go over bad roads the packages are opened by the purchaser and the contents packed in bags, which are carried by pack animals.

The marketing of crops has some connection with the fish trade in the securing of return cargoes by vessels arriving with cargoes of fish. Coffee crops are moved from the last of October up to June; sugar crops from the last of January until the end of May. In 1899 the sugar crop began to move the first part of January, somewhat earlier than usual. Return cargoes can usually be had from the first of February up to the end of April.

Mayaguez.—This city, with a population of 15,187, ranks third in its fishery imports, and has for a long time been a receiving and distributing point for a large amount of imported fishery products. Imported fish are distributed by sales through the interior, with occasional transfers of cargoes to other ports in which supplies are needed. The receipts of dry and pickled fish in 1897 were as follows:

From—	Kilograms.	Pounds.	Value.
British North American Possessions	2,235,907	4,929,328	$290,587.91
United States	122,903	270,955	15,458.39
Spain	2,206	4,863	286.78
Total	2,361,016	5,205,146	306,333.08

The imports of canned fish (chiefly sardines) were comparatively unimportant, being valued at only $19,732, of which $19,517 worth came from Spain. Boneless fish are unknown, but dealers express a desire for experimental lots, well cured, and hope to create a demand for boneless and canned fish, but do not encourage large shipments at first.

The best months for meeting with a good demand are January, February, March, and April. Shipments by the New York and Porto Rico Steamship Line can be made three times a month. These steamers do a freight and passenger business, making regular calls at Mayaguez, San Juan, and Ponce, and if there is sufficient inducement landings are made at Arecibo, Aguadilla, and Arroyo.

When cargo shipments by sail are made, return cargoes of sugar and molasses can generally be secured from the month of February to and including August. At the time this port was visited, during the latter part of January, 1899, no cargo lots of fish had been received for some time, and the freight rates by steamer only could be given. These were: For sugar in hogsheads 22 cents per 100 pounds, and 18 cents per 100 pounds when in bags. These rates are somewhat higher than in the previous year.

Wholesale values of dry cod (per 100 pounds) for the past three years are here shown by months, as ascertained from the books of dealers at Mayaguez:

Month.	1896.	1897.	1898.
January	$5.50	$5.50	$6.00
February	....	6.00	7.00
March	5.00	5.50	7.00
April	4.50	6.00	7.50
May	5.50	7.00	9.25
June	6.25	8.00	10.50
July	5.50	7.00	8.25
August	4.50	5.00	....
September	8.75	5.50	....
October	9.00	6.25	10.50
November	7.00	6.00	10.00
December	6.00	6.50	8.25
Average	6.12¼	6.20	8.50

During January, 1899, the market was as follows:

Cod-fish, $8 per 100 pounds; hake, $5 to $6 per 100 pounds.
Haddock, $7 per 100 pounds; pollock, $5 to $6 per 100 pounds.
Pickled herring, $4 to $6 per barrel for round and split; the latter $1 a barrel more than round.
Sardines in oil or mustard, in ¼-pound boxes, 70 to 90 cents a dozen.

Arecibo.—The population of Arecibo is 8,008. In the imports of dry and pickled fish this city ranks fourth in the amount of value, which in 1897 were as follows:

From—	Kilograms.	Pounds.	Value.
British North American Possessions ..	1,173,279	2,586,636	$152,426.27
United States..........................	7,673	16,916	997.49
Total	1,180,952	2,603,552	153,423.76

Canned fish imports were all from Spain, amounting to $2,333.

Of the dry fish handled, some 25 per cent additional to the above was received from the San Juan and Ponce importers. The original importers of the several ports draw on or supply each other according to the condition of the trade. The imports for 1897 are said to have been on an average with those of past years. The principal fishery imports consisted of small-sized dry cod from Nova Scotia.

Aguadilla.—This place has a population of 6,425 and is of considerable importance as a distributing point for the surrounding country. The fish handled annually is stated to amount to about 2,500 tierces of dry cod, 500 barrels of pickled herring, and a small quantity of smoked and canned fish. Very little is imported direct, the supplies in general being bought as needed from importers at Ponce, San Juan, and Mayaguez. Occasionally small orders are sent to the United States. The direct imports of fish in 1897 amounted to 19,965 kilograms, or 44,015 pounds; $2,595 worth of dry fish came from New York and $2,845 worth of canned fish from Spain. Nearly all dry fish handled are quite small, these being preferred to those of medium size.

Boneless fish are unknown, and canned fish of American pack are seldom used. Dealers express a desire to increase their business with the United States, in the hope of receiving a better class of goods, adapted to their trying climate, the losses from fish turning red and spoiling being considerable.

Arroyo.—This is the port of entry for the southeastern part of the island and has a population of 2,137. Dry and pickled fish are largely used and distributed through the interior, the monthly receipts averaging 120 tierces of dry fish. Most of the fish products come from importers at Ponce, the direct imports being small, as shown by the custom-house records during the past six years, as follows:

Year.	Kilograms.	Pounds.	Value.
1893..	None.	None.	....
1894..	1,482	3,267	$148
1895..	32,331	71,278	5,203
1896..	6,350	13,999	825
1897..	None.	None.	....
1898..	60,116	132,533	7,815

The imports in 1894 were all from the United States, those for the other years were from Nova Scotia. The only direct import in 1898 comprised 200 tierces and 3 boxes of cod-fish and 100 barrels of herring, from Lunenburg, Nova Scotia.

STATISTICS.

Imported fishery products being next to the largest in value of all the imports of Porto Rico, the following statistical tables will be found of much interest and importance. The records were taken from the original entries at the several custom-houses of the island. In all cases where value is given it is on a basis of Spanish paper money, which has had a fluctuating value, the average during the time shown in the tables being some 60 cents on a dollar for gold.

Table showing, from countries received and by ports of entry, the quantity, value, and duty paid on fishery products imported into Porto Rico in 1897.

Imported from—	Ports of entry.	Dry, pickled, and smoked fish.		Canned fish.		Shellfish.		Total.	
		Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
British North American provinces.	Ponce	13,080,247	$771,303.52					13,080,247	$771,303.52
	San Juan	7,452,524	439,453.30					7,452,524	439,453.30
	Mayaguez	4,929,328	290,587.91					4,929,328	290,587.91
	Arecibo	2,586,636	152,526.27					2,586,636	152,526.27
	Total	28,048,735	1,653,871.00					28,048,735	1,653,871.00
United States	Ponce	3,984,809	234,972.50	732	$166.00			3,985,541	235,138.50
	San Juan	592,446	34,934.77	3,554	806.00	253	$8.00	596,253	35,748.77
	Mayaguez	270,955	15,458.39	44	10.00			270,999	15,468.39
	Aguadilla	44,015	2,595.45					44,015	2,595.45
	Arecibo	16,916	997.49					16,916	997.49
	Total	4,909,141	288,958.60	4,330	982.00	253	8.00	4,913,724	289,948.60
Norway	San Juan	97,958	5,776.29					97,958	5,776.29
Sweden	San Juan	41,445	2,443.87					41,445	2,443.87
Scotland	San Juan	862	50.83					862	50.83
France	Ponce	5,366	316.42	811	184.00			6,177	500.42
	San Juan	238	14.04	8,353	1,894.50			8,591	1,908.54
	Mayaguez			904	205.00			901	205.00
	Total	5,604	330.46	10,068	2,283.50			15,672	2,613.96
Spain	Ponce			25,609	5,808.00			25,609	5,808.00
	San Juan	161,636	9,531.21	479,790	108,814.50			641,426	118,345.71
	Mayaguez	4,863	286.78	124,766	19,517.00			129,629	19,803.78
	Aguadilla			12,544	2,845.00			12,544	2,845.00
	Arecibo			10,287	2,333.00			10,287	2,338.00
	Total	166,499	9,817.99	652,996	139,317.50			819,495	149,135.49
Italy	Ponce			148	33.50			148	33.50
	San Juan	2,028	119.60	168	38.00			2,196	157.60
	Total	2,028	119.60	316	71.50			2,344	191.10
England	Ponce	155,252	9,854.73	36,222	8,215.30			191,474	18,070.03
	San Juan	218	12.87	1,534	348.00			1,752	360.87
	Total	155,470	9,867.60	37,756	8,563.30			193,226	18,430.90
Germany	San Juan	21,680	1,278.42	842	191.00			22,522	1,469.42
Totals	Ponce	17,225,674	1,016,447.17	63,522	14,406.80			17,289,196	1,030,853.97
	San Juan	8,371,035	493,615.20	494,241	112,092.00	253	8.00	8,865,529	605,715.20
	Mayaguez	5,205,146	306,333.08	125,714	19,732.00			5,330,860	326,065.08
	Aguadilla	44,015	2,595.45	12,544	2,333.00			56,559	5,440.45
	Arecibo	2,603,552	153,523.76	10,287	2,845.00			2,613,839	155,856.76
	Grand total.	33,449,422	1,972,514.66	706,308	151,408.80	253	8.00	34,155,983	2,123,931.46

Table showing, from countries received, the quantity and value of fishery products imported into Porto Rico during 1893, 1894, 1895, 1896, and 1897.

Imported from—	Dry, pickled, and smoked fish.		Canned fish.		Shellfish.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
1893.								
British North American provinces	20,538,095	$1,211,070.77					20,538,095	$1,211,070.77
United States	785,264	46,304.70	33,781	$7,661.50			819,045	53,966.20
Norway and Sweden	24,079	1,419.86					24,079	1,419.86
France			2,526	1,995.50			2,526	1,995.50
Spain	299,235	17,645.03	148,896	33,769.00	7,500	$272.16	455,631	51,686.19
England	2,747	161.98	6,510	1,476.50	2,010	72.96	11,267	1,711.44
Germany	49,410	2,913.56	1,354	307.00			50,764	3,220.56
Total	21,698,830	1,279,515.90	193,067	45,209.50	9,510	345.12	21,901,407	1,325,070.52
1894.								
British North American provinces	21,804,202	1,285,729.38					21,804,202	1,285,729.38
United States	3,355,890	197,886.91	84,854	19,244.50	265	9.60	3,441,009	217,141.01
Norway and Sweden	23,788	1,402.70			1,587	57.60	25,375	1,460.30
France	1,281	75.53	13,803	3,130.50	3,858	140.00	18,942	3,346.03
Spain	124,003	7,312.11	552,727	125,356.50	110	4.00	676,840	132,672.61
Italy	317	18.72					317	18.72
England	772	45.50	22,648	5,136.50			23,420	5,182.00
Germany	51,476	3,035.37	2,968	673.00			54,444	3,708.37
Holland			1,512	343.00			1,512	343.00
Total	25,361,729	1,495,506.22	678,512	153,884.00	5,820	211.20	26,046,061	1,649,601.42
1895.								
British North American provinces	27,291,194	1,609,281.05					27,291,194	1,609,281.05
United States	1,696,238	100,022.13	1,938	439.50	207	7.52	1,698,383	100,469.15
Norway and Sweden	71,957	4,244.07					71,957	4,244.07
France			5,837	1,210.50			5,337	1,210.50
Spain	61,516	3,627.39	1,173,526	266,151.50	9,879	358.48	1,244,921	270,137.37
Italy			172	39.00			172	39.00
England	2,161	127.40	1,781	404.00			3,942	531.40
Germany	5,090	300.17	2,072	470.00			7,162	770.17
Denmark	16,854	993.85					16,854	993.85
Total	29,145,010	1,718,596.06	1,184,826	268,714.50	10,086	366.00	30,339,922	1,987,676.56
1896.								
British North American provinces	26,399,153	1,556,680.06					26,399,153	1,556,680.06
French North American provinces	154,919	9,135.10					154,919	9,135.10
United States	1,606,538	94,732.82	14,976	3,396.50	183	6.64	1,621,697	98,135.96
Norway and Sweden	101,355	5,976.62					101,355	5,976.62
France	12,875	759.20	9,328	2,115.50			22,203	2,874.70
Spain	190,411	11,227.97	547,048	124,068.50	51	1.84	737,510	135,298.31
Italy			79	18.00			79	18.00
England	1,662	98.02	8,003	1,815.00			9,665	1,913.02
Germany	35,797	2,110.81	794	180.00			36,591	2,290.81
Denmark	24	12.35					24	12.35
Venezuela	45,195	2,665.00					45,195	2,665.00
Cuba					302	10.96	302	10.96
Total	28,547,929	1,683,397.95	580,228	131,593.50	536	19.44	29,128,693	1,815,010.89
1897.								
British North American provinces	28,048,735	1,653,871.00					28,048,735	1,653,871.00
United States	4,909,141	288,958.60	4,330	982.00	253	8.00	4,913,724	289,948.60
Norway	97,958	5,776.29					97,958	5,776.29
Sweden	41,445	2,443.87					41,445	2,443.87
Scotland	862	50.83					862	50.83
France	5,604	330.46	10,068	2,283.50			15,672	2,613.96
Spain	166,499	9,817.99	652,996	139,317.50			819,495	149,135.49
Italy	2,028	119.60	316	71.50			2,344	191.10
England	155,470	9,867.60	37,756	8,563.30			193,226	18,430.90
Germany	21,680	1,278.42	842	191.00			22,522	1,469.42
Total	33,449,422	1,972,514.66	706,308	151,408.80	253	8.00	34,155,983	2,123,931.46

In the following table are given the quantity and value of fish and fishery products imported by Porto Rico during calendar year 1899. The figures are those of the division of customs and insular affairs, War Department, and were published in the bulletins giving a monthly summary of commerce of the island of Porto Rico. No figures are available for the year 1898.

Imported from—	January.		February.		March.		April.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Germany			2,200	$120	1,654	$80		
United States	221,898	$9,195	310,457	14,566	245,438	9,076	276,664	$10,932
France	17,045	673						
Spain	59,576	4,467	8,331	721	85,124	5,094	36,260	1,884
Italy			736	212				
Canada and Nova Scotia	309,586	11,423	1,919,028	64,313	1,940,556	78,320	2,047,881	68,403
Cuba					960	28		
Total	608,105	25,758	2,240,752	79,932	2,273,732	92,598	2,360,805	81,219

Imported from—	May.		June.		July.		August.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Germany	780	$62	4,167	$232	1,088	$127	1,885	$182
United Kingdom					43,230	1,941		
United States	574,247	18,347	995,448	15,981	823,228	23,230	549,301	14,360
France	11,600	1,212	842	24	41	20	297	42
Spain	9,764	513	30,610	1,164			51,390	744
Italy					865	249	745	201
Canada and Nova Scotia	1,475,709	53,783	418,947	14,437	1,898,033	71,243	820,432	338,93
Total	2,072,100	73,917	1,450,014	31,838	2,766,485	96,810	1,424,050	49,417

Imported from—	September.		October.		November.		December.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Germany	350	$27	2,015	$154					14,139	$934
United Kingdom									43,230	1,941
United States	92,840	2,368	605,717	23,344	52,294	$976	179,824	$10,742	4,927,356	153,117
France	13,025	518	26	5	471	73			43,347	2,567
Spain	11,247	461	42,715	2,224			547	136	335,564	17,411
Italy									2,346	662
Canada and Nova Scotia	674,628	20,905	1,080,653	36,078	125,346	3,513	44,638	1,589	12,755,437	457,945
Cuba									960	28
Total	792,090	24,282	1,731,126	61,805	178,111	4,562	225,009	12,467	18,127,379	634,560

THE FISHES OF PORTO RICO,

BY

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AND

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THE FISHES OF PORTO RICO.

By BARTON W. EVERMANN and MILLARD C. MARSH.

INTRODUCTION.

In preparing this report upon the fishes of Porto Rico it seemed desirable to include not only those obtained by us, but to give diagnoses of all the families and genera and detailed descriptions of all the species now known from those waters. That the species may be readily determined we have given very full keys leading to the definite identification of each, including certain genera and species which, though not yet actually known from Porto Rican waters, may hereafter be found to occur there. The unrecorded genera and species are, however, not numbered in the keys. The keys to the families are also of the same character.

The keys and all the diagnoses of families and genera are adapted from "The Fishes of North and Middle America," by Jordan & Evermann, which work we have followed in the arrangement and sequence of genera and species.

The descriptions of all the species of which we have specimens have either been wholly from Porto Rican material or verified upon specimens from that island, and in the majority of cases the color descriptions are from living specimens.

The common names inclosed in quotation marks are the names by which the species are known in Porto Rico. The other common names are those by which the species are known at Key West or elsewhere.

It has not been the intention to give much synonymy. In every case reference is made to the original description of each species, to all original synonyms, to Poey's and Stahl's papers on Porto Rican fishes, and to Jordan & Evermann's "Fishes of North and Middle America." The locality named at the end of each reference is that from which the type of the species came.

Of the 49 colored plates, 33 were made by Mr. A. H. Baldwin, and 16 by Mr. C. B. Hudson. All those by Mr. Baldwin were painted on board the *Fish Hawk*, the fish being placed in an aquarium as soon as caught and the life colors gotten before they had undergone any appreciable change.

Among the fishes painted from life by Mr. Hudson at Key West, Fla., in the winter of 1897–98, are 16 species which occur in Porto Rico, and his paintings of those are used in this report. The fish were selected from those (usually a large number) brought in by the fishermen in the live-wells of their boats and transferred to a large aquarium on the pier only a few feet distant from the fishing boats, where they were kept in as nearly a normal condition as possible while being painted. We can not give too high praise to the artists, Mr. Hudson and Mr. Baldwin, for the care and fidelity with which they have done their work. All who are familiar with the life-colors of the species and who have seen these paintings have been struck with their accuracy, both as to color and structural detail.

The lithographers, Messrs. Julius Bien & Co., have given faithful and satisfactory reproductions of the originals.

Besides the colored plates of 49 species, 115 drawings were to be reproduced, each 5.25 inches long, as cuts illustrating the text. But as these pages were being written all of these drawings were destroyed by fire in New York. Steps were at once taken to have the 28 new species redrawn. Some of the others can not be replaced, but 82 of them had recently been reproduced in the "Fishes of North and Middle America," by Jordan & Evermann, and through the courtesy of the U. S. National Museum the same blocks are used for illustrating this report, but we were thus compelled to have them appear 4.25 inches long instead of 5.25 inches, as originally intended.

Another serious loss was incurred by the burning of the model and training school at San Juan, July 1, resulting in the total destruction of a valuable collection of fishes made in the vicinity of San Juan by Mr. Oscar Riddle, and his notes upon them, both of which he was about sending for use in preparing the present paper.

As already stated, the investigations of the Fish Commission in Porto Rican waters, though extending over about forty-five days and really embracing not over thirty-eight days of actual work, resulted in adding to the known fish fauna of the island nearly 200 species, among which were 3 genera and 33 species which are new to science. The 3 new genera and 20 of the new species were described by the present writers in the Annual Report of the U. S. Fish Commission for 1899.[1]

One of the new eels (*Aphthalmichthys caribbeus*), the type of which was collected by Mr. G. M. Gray, was described by Drs. Gill and Smith in Science for June 22, 1900.[2]

The following is a full list of the new genera and species resulting from these investigations. Those which appear for the first time in this report are indicated by the star. The number following each name is that which the type specimen bears on the register of the U. S. National Museum, in which all the types are deposited. Cotypes of species of which duplicate specimens were obtained are in the reserve series of the U. S. Fish Commission and in the Museum of Leland Stanford Junior University.

Species.	Type No.	Species.	Type No.
Aphthalmichthys caribbeus		Bollmannia boqueronensis	49366
Sphagebranchus ophioneus*	49526	Microgobius meeki	49367
Lycodontis albimentis*	49527	Gillias	
Lycondontis jordani	49358	Gillias jordani	49368
Stolephorus lyolepis*	49528	Malacoctenus culebræ	49369
Stolephorus gilberti	49359	Malacoctenus moorei	49370
Stolephorus garmani	49360	Malacoctenus puertoricensis	49371
Apogon sellicauda*	49529	Auchenopterus albicaudus	49373
Mycteroperca bowersi*	49530	Auchenopterus fajardo	49376
Prionodes baldwini	49361	Auchenopterus rubescens	49374
Neomænis megalophthalmus*	49531	Auchenopterus cingulatus	49375
Calamus kendalli	49362	Auchenistius	
Doratonotus decoris	49363	Auchenistius stahli	49372
Scorpæna albifimbria*	49532	Coralliozetus	
Scorpæna bergii*	49533	Coralliozetus cardonæ	49377
Pontinus beanorum*	49534	Emblemaria pandionis*	49535
Sicydium caguitæ	49364	Citharichthys arenaceus*	49536
Gobius bayamonensis	49365	Halieutichthys smithii*	49537

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[1] Description of new genera and species of fishes from Porto Rico. <Report U. S. Fish Com. 1899 (December 19), 351-362.

[2] The Moringuoid Eels in American Waters, by Theo. Gill and H. M. Smith. <Science, N. S., vol. XI, No. 286, pp. 973-974, June 22, 1900.

The total number of fishes now known from Porto Rican waters is 291 species. Prior to the investigations by the U. S. Fish Commission the number was 99. Of the 291 species, 263 were obtained by us, and of this number 33 species proved to be new, which is more than 12.5 per cent of the species collected by us, or 11.3 per cent of the entire known fish fauna of the island.

The 291 species represent 76 families and 165 genera, 3 of the latter being new. The majority of the families and genera are represented by but few species each. Among the families with largest representation are the grunts (*Hæmulidæ*), with 17 species; the sea basses and groupers (*Serranidæ*), with 16 species; the pampanos (*Carangidæ*) and parrot-fishes (*Scaridæ*), with 15 species each; and the blennies (*Blenniidæ*) and gobies (*Gobiidæ*), with 14 species each. The snappers (*Lutianidæ*) are represented by 11 species. The largest genera are *Sparisoma*, with 11 species; *Neomænis*, with 10; *Hæmulon* and *Stolephorus*, with 8 each; and *Caranx*, *Scorpæna*, and *Auchenopterus*, with 5 each. Several families and many genera are represented by a single species each.

The food-fishes of the island are numerous as to species, but only fairly abundant as to individuals. The absence of extensive shoals or banks about the island, the comparatively limited area of shallow water about the river mouths, and the fewness and small size of the bays, are evidence that there can not be suitable feeding-grounds such as could support large numbers of commercial fishes. The number of species of fishes used as food is, however, large, as is shown in the chapter on the commercial fisheries of the island.

A comparison of the fish fauna of Porto Rico with that of Cuba and other neighboring regions will prove interesting. Poey records 499 species from Cuba, 301 of which have not been taken in Porto Rico. Of the 291 species known from Porto Rico, 198 are common to it and Cuba, while 93 of them are not known from Cuba.

The number of species known from the Florida Keys is almost exactly the same as the number recorded from Porto Rico. With few exceptions the food-fishes found at Key West, Habana, and Porto Rico are identical, and the same is true for Jamaica, from which Jordan & Rutter give a list of 197 species. Of these, 45 were not obtained by us, and of our 291 species, 139 were not listed by them from Jamaica.

The species common to Key West, Habana, Jamaica, and Porto Rico, however, show that those four regions belong to one fauna—the West Indian. It is true that at Key West are found a number of species which are not yet known from the West Indies, and which probably do not occur among them, but they are mostly stragglers or the peripheral species of the faunas of the Gulf and the coast of the South Atlantic States.

Another remarkable feature of the Porto Rican fish fauna is the paucity in the representation of the cyprinodonts. The family *Pœciliidæ* is a large one, and in most of our tropical waters it is represented by many species. From Florida 21 species of this family are recognized, but only 2 are known from Porto Rico. This great difference is doubtless largely due to the marked difference in the character of the environment. The *Pœciliidæ* are chiefly fishes of brackish water and mud bottom, conditions adequately met in Florida, but almost entirely absent from Porto Rico.

KEY TO THE FAMILIES OF FISHES REPRESENTED IN WEST INDIAN WATERS.[1]

I.—VENTRAL FINS PRESENT, ABDOMINAL.

A. Back with an adipose fin behind the single-rayed dorsal fin.
B. Head with 4 to 8 long barbels about the mouth and nostrils .... SILURIDÆ.
BB. Head without barbels as described above.
C. Sides of body without photophores or luminous glands; no barbel at throat.
D. Pseudobranchiæ present.
E. Maxillary very narrow, rudimentary, or obsolete; hypocoracoids not divergent .... SYNODONTIDÆ.
EE. Maxillary well developed, dilated behind; pectoral normal; hypocoracoids mostly divergent .... AULOPIDÆ.
DD. Pseudobranchiæ absent.
F. Pectoral undivided, subhumeral; pseudobranchiæ absent .... BENTHOSAURIDÆ.
FF. Pectoral rays elongate, arranged in two groups .... BATHYPTEROIDIDÆ.
CC. Sides of body with photophores more or less developed. Barbel at throat present, very long; body naked. ASTRONESTHIDÆ.
G. Vertebral spines projecting through skin of back before dorsal fin; body short and deep, greatly compressed. STERNOPTYCHIDÆ.
GG. Vertebral spines not exserted in front of dorsal.
H. Pseudobranchiæ present.
I. Premaxillaries forming entire margin of upper jaw; body scaly; opercular apparatus complete.
J. Form elongate, the snout pointed, barracuda-like; photophores very small .... PARALEPIDIDÆ.
JJ. Form oblong, the snout not much produced; photophores conspicuous .... MYCTOPHIDÆ.
II. Premaxillaries not forming the whole margin of upper jaw, the maxillary entering into it; body naked; opercular apparatus incomplete .... MAUROLOCIDÆ.
HH. Pseudobranchiæ absent; mouth large, with canine teeth; scales deciduous or wanting .... CHAULIODONTIDÆ.
AA. Back without adipose fin.
B. Dorsal fin single, made up of rays, and not preceded by a series of free spines or followed by finlets.
C. Tail evidently strongly heterocercal; scales ganoid; no gular plate; dorsal fin short .... LEPISOSTEIDÆ.
CC. Tail not evidently heterocercal.
D. Tail tapering to a point, without caudal fin; anal fin very long, of about 200 rays; body scaly .... HALOSAURIDÆ.
DD. Tail not tapering to a point; caudal fin developed.
E. Body naked.
F. Throat with a long barbel; no caudal filament; mouth large.
G. Barbel free at tip .... STOMIATIDÆ.
GG. Barbel connecting throat with symphysis of lower jaw .... MALACOSTEIDÆ.
FF. Throat without barbel.
H. Caudal fin with a long filament; body elongate; mouth very small .... FISTULARIIDÆ.
HH. Caudal fin without filament. Pectorals present .... RONDELETIIDÆ.
EE. Body scaly.
I. Head with a large divided luminous plate in place of eyes .... IPNOPIDÆ.
II. Head with normally developed eyes.
J. Anal fin with many spines; mouth toothless, sucker-like .... LIPOGENYIDÆ.
JJ. Anal fin without distinct spines.
K. Pectoral fins inserted high, near axis of body; lower pharyngeals united; lateral line along side of belly.
L. Jaws each with long sharp teeth mixed with smaller ones .... ESOCIDÆ.
LL. Jaws with small equal, conic or tricuspid teeth.
M. Lower jaw more or less produced; teeth tricuspid .... HEMIRAMPHIDÆ.
MM. Lower jaw a little produced; teeth conic; pectoral elongate, forming an organ of flight .... EXOCŒTIDÆ.
KK. Pectoral fins inserted below axis of body; lower pharyngeals separate.
N. Phosphorescent spots present; teeth unequal .... CHAULIODONTIDÆ.
NN. Phosphorescent spots none.
O. Head scaly, more or less.
P. Maxillaries connate with premaxillaries; jaws long .... SYNODONTIDÆ.
PP. Maxillaries distinct; upper jaw protractile, its margin formed by premaxillaries alone; no lateral line . PŒCILIIDÆ.
OO. Head naked.
Q. Dorsal fin inserted more or less before anal (rarely slightly behind it); shore fishes or river fishes, usually silvery in coloration and with skeleton firm; air-bladder well developed.
R. Gular plate present, between branches of lower jaw; mouth large; teeth present, all pointed; axillary scales and sheaths large .... ELOPIDÆ.
RR. Gular plate none.
S. Lateral line well developed; mouth small, horizontal; posterior part of tongue and roof of mouth covered with coarse-paved teeth .... ALBULIDÆ.
SS. Lateral line wanting; no gular plate.
T. Mouth moderate, terminal, the maxillary of about 3 pieces; stomach not gizzard-like .... CLUPEIDÆ.
TT. Mouth subinferior, very large, below a tapering, pig-like snout; maxillary very long .... ENGRAULIDIDÆ.
QQ. Dorsal fin posterior, opposite anal; deep-sea fishes, of loose organization; mostly blackish in color; mouth small, with small pointed teeth; air-bladder wanting .... ALEPOCEPHALIDÆ.

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[1] The lancelets, sharks, and rays are not included in this key.

BB. Dorsal fin single, preceded by free spines. Body scaly; snout tubular.......... AULOSTOMIDÆ.
BBB. Dorsal fin composed of free spines; ventrals with 1 or 2 spines each; body elongate.......... NOTACANTHIDÆ.
BBBB. Dorsal fins 2, the anterior of spines only, the posterior chiefly of soft rays.
U. Pectoral fin with 5 to 8 lowermost rays detached and filamentous.......... POLYNEMIDÆ.
UU. Pectoral fin entire.
V. Teeth strong, unequal; lateral line present.......... SPHYRÆNIDÆ.
VV. Teeth small or wanting; lateral line obsolete.
W. Dorsal spines 4, stout; anal spines 3.......... MUGILIDÆ.
WW. Dorsal spines 4 to 8, slender; anal spine single.......... ATHERINIDÆ.

II.—VENTRAL FINS PRESENT, THORACIC OR SUBJUGULAR, NUMBER OF RAYS DEFINITELY I, 5.

A. Gill-openings in front of the pectoral fins.
B. Body more or less scaly or armed with bony plates.
C. Ventral fins completely united; gill-membranes joined to the isthmus; no lateral line.......... GOBIIDÆ.
CC. Ventral fins separate.
D. Suborbital with a bony stay, which extends across the cheek to or toward the preopercle; cheeks sometimes entirely mailed.
E. Pectoral fin with 3 lower rays detached and free; head bony.......... TRIGLIDÆ.
EE. Pectoral fin with 2 lower rays detached and free; body mailed.......... PERISTEDIIDÆ.
EEE. Pectoral fin entire; slit behind fourth gill small or wanting.
F. Dorsal spines 4; lips fringed; eyes superior.......... URANOSCOPIDÆ.
FF. Dorsal spines 8 to 17; anal spines 3; body scaly.......... SCORPÆNIDÆ.
DD. Suborbital stay wanting; cheeks not mailed.
G. Spinous dorsal transformed into a sucking disk on top of head, composed of 8 to 30 transverse plates.. ECHENEIDIDÆ.
GG. Spinous dorsal (if present) not transformed into a sucking disk.
H. Dorsal spines all or nearly all disconnected from each other.
I. Body elongate, spindle-shaped.......... RACHYCENTRIDÆ.
II. Body oblong or ovate, compressed.
J. Caudal peduncle very slender, the fin widely forked; preopercle entire.......... CARANGIDÆ.
JJ. Caudal peduncle stoutish, the fin little forked. Gill-membranes broadly united to isthmus.......... EPHIPPIDÆ.
HH. Dorsal spines (if present) all, or most of them, connected by membrane.
K. Pectoral fin with 4 to 9 lowermost rays detached and filiform.......... POLYNEMIDÆ.
KK. Pectoral fin entire.
L. Dorsal and anal each with 1 or more detached finlets.
M. Anal preceded by 2 free spines.......... CARANGIDÆ.
MM. Anal not preceded by 2 free spines.
N. Caudal peduncle keeled.......... SCOMBRIDÆ.
NN. Caudal peduncle not keeled.......... GEMPYLIDÆ.
LL. Dorsal and anal without finlets.
O. Lateral line armed posteriorly with a series of keeled plates; 2 free anal spines; gill-membranes free from isthmus. CARANGIDÆ.
OO. Lateral line armed posteriorly with a sharp, movable, lancet-like spine, or with a few bony tubercles; scales small, rough; gill-membranes adherent to isthmus.......... TEUTHIDIDÆ.
OOO. Lateral line unarmed.
P. Throat with 2 long barbels (placed just behind chin); dorsal fins 2.......... MULLIDÆ.
PP. Throat without long barbels.
Q. Anal fin preceded by 2 free spines (these obsolete in very old, joined by membrane in very young)..... CARANGIDÆ.
QQ. Anal fin not preceded by free spines.
R. Nostril single on each side; lateral line interrupted; lower pharyngeals united.
S. Anal spines 2.......... POMACENTRIDÆ.
SS. Anal spines 3 to 11. Fresh-water fishes.......... CICHLIDÆ.
RR. Nostril double on each side.
T. Lateral line extending to tip of middle rays of caudal.
U. Anal spines 3, the second strong.
V. Dorsal fins 2, separate; body elongate.......... CENTROPOMIDÆ.
VV. Dorsal fin continuous.......... HÆMULIDÆ.
UU. Anal spines 1 or 2, the second large or small.......... SCIÆNIDÆ.
TT. Lateral line not extending beyond base of caudal fin.
W. Gills 3.5, the slit behind the last very small or wanting.
X. Mouth not vertical, lips not fringed; dorsal fin continuous, spines 8 to 18; scales cycloid; lower pharyngeals united.
Y. Teeth in each side of each jaw united, forming a sort of beak.......... SCARIDÆ.
YY. Teeth distinct or nearly so, the anterior usually more or less canine.......... LABRIDÆ.
XX. Mouth nearly vertical, the lips with fleshy fringes; dorsal divided, the spinous part short, of about 4 spines; lower pharyngeals separate.......... URANOSCOPIDÆ.
WW. Gills 4, a long slit behind the fourth.
Z. Teeth setiform, like the teeth of a brush; body elevated, longer than deep, the soft fins completely scaled.
a. Dorsal fin continuous.......... CHÆTODONTIDÆ.
aa. Dorsal fin divided.......... EPHIPPIDÆ.

ZZ. Teeth not setiform.
b. Body deeper than long, covered with rough scales; dorsal spines 8; anal spines 3; soft fins very long....CAPROIDÆ.
bb. Body longer than deep.
c. Gill-membranes broadly joined to isthmus; body long and low; no lateral line....GOBIIDÆ.
cc. Gill-membranes free from isthmus or very nearly so.
d. Premaxillaries excessively protractile, their basal process very long, in a groove at top of cranium.
e. Teeth small; scales large, silvery; spines strong....GERRIDÆ.
ee. Teeth none; spines slender....MÆNIDÆ.
dd. Premaxillaries moderately protractile or not protractile.
f. Lateral line incomplete or interrupted, running close to dorsal fin; dorsal spines very slender, continuous with the soft rays; body low, covered with small scales; anal fin very long....OPISTHOGNATHIDÆ.
ff. Lateral line, if present, not as above.
g. Anal fin much longer than dorsal; body much compressed, the belly prominent....PEMPHERIDIDÆ.
gg. Anal fin not much, if any, longer than dorsal.
h. Pseudobranchiæ wanting or covered by skin; dorsal fin of soft rays, only beginning as a crest on the head; caudal widely forked. Pelagic fishes....CORYPHÆNIDÆ.
hh. Pseudobranchiæ developed.
i. Spinous dorsal of 2 or 3 short spines only; anal without spines; scales small, smooth....SERRANIDÆ.
ii. Spinous dorsal, if present, not as above.
j. Dorsal fin continuous, the spines few, slender; maxillary usually with an enlarged tooth behind; nape sometimes with an adipose appendage; anal fin long, even....MALACANTHIDÆ.
jj. Dorsal fin continuous or divided, not as above.
k. Perch-like fishes, the caudal peduncle not very slender, the scales well developed, ctenoid or cycloid; the dorsal with distinct spines; the anal with at least 1 spine, its soft rays usually few.
l. Maxillary not sheathed by the preorbital, or only partially covered by the edge of the latter; ventral with its accessory scale very small or wanting; pectoral without accessory scale; sheath at base of spinous dorsal little developed; vomer usually with teeth; opercle usually ending in a spine.
m. Precaudal vertebræ with transverse processes from the third or fourth to the last; ribs all but the last 1 to 4 sessile, inserted on the centra behind the transverse processes; anal spines 3; species silvery in color, the dorsal deeply notched, with 10 spines; vertebræ 10+15=25....KUHLIIDÆ.
mm. Precaudal vertebræ normal, anteriorly without transverse processes; all or most of the ribs inserted on the transverse processes when these are developed.
n. Anal spines 2, rarely 3; vertebræ 24 or 25; dorsal fin divided. Marine fishes....CHEILODIPTERIDÆ.
nn. Anal spines 3, never 2 nor 1; dorsal fin continuous or divided; vertebræ 24 to 35.
o. Vomer, and usually palatines also, with teeth.
p. Anal fin shorter than dorsal; head not everywhere covered with rough scales; postocular part of head not shortened....SERRANIDÆ.
p. Anal fin scarcely shorter than dorsal and similar to it; head and body everywhere covered with rough scales; body deep, compressed, the posterior part of head shortened....PRIACANTHIDÆ.
oo. Vomer without teeth; dorsal fin continuous; body deep, compressed....LOBOTIDÆ.
ll. Maxillary slipping for most of its length under the edge of the preorbital, which forms a more or less distinct sheath; ventrals with an accessory scale; opercle without spines; maxillary without supplemental bone; anal spines 3, rarely 2.
q. Fishes carnivorous; intestine of moderate length; teeth in jaws not all incisor-like; vertebræ usually 24 or 25.
r. Vomer with teeth, these sometimes very small; maxillary long....LUTIANIDÆ.
rr. Vomer without teeth; palatines and tongue toothless.
s. Teeth on sides of jaws not molar; maxillaries formed essentially as in the *Serranidæ*; preopercle mostly serrate. HÆMULIDÆ.
ss. Teeth on sides of jaws molar; maxillaries peculiar in form and in articulation; anterior teeth conical or else more or less incisor-like; preopercle entire....SPARIDÆ.
qq. Fishes herbivorous; intestinal canal elongate; anterior teeth in jaws incisor-like; no molars or canines; premaxillaries moderately protractile....KYPHOSIDÆ.
kk. Mackerel-like fishes, with the caudal peduncle usually very slender, the fin widely forked, the scales various, usually not ctenoid; the dorsal spines various; anal fin long.
t. Scales firm, linear, parchment-like; body compressed; bones of head rough; dorsal spines few; mouth small. GRAMMICOLEPIDIDÆ.
tt. Scales not linear, mostly cycloid.
u. Dorsal fin very long, all the rays soft; skeleton soft....ICOSTEIDÆ.
uu. Dorsal fin with 3 or more spines.
v. Dorsal fin divided, the spines 6 to 12 in number.
w. Scales weak, cycloid; jaws without canines....NOMEIDÆ.
ww. Scales firm, each with a median ridge; no canines....STEINEGERIIDÆ.
vv. Dorsal spines 3 or 4, the fin not divided.
BB. Body scaleless, smooth or armed with tubercles, prickles, or scattered bony plates.
C. Breast with a sucking disk; gill-membrane free from the isthmus; no spinous dorsal....GOBIESOCIDÆ.
CC. Breast without sucking disk.
D. Gill-membranes broadly attached to the isthmus.
E. Ventrals completely united....GOBIIDÆ.
EE. Ventrals widely separated; body depressed; preopercle with a strong spine....CALLIONYMIDÆ.
DD. Gill-membranes nearly or quite free from the isthmus.

F. Anal preceded by 2 free spines (these lost with age; connected by membranes in the very young) ....CARANGIDÆ.
FF. Anal without free spines.
G. Dorsal and anal fins followed by finlets........SCOMBRIDÆ.
GG. Dorsal and anal without finlets; mouth very large, nearly horizontal, the teeth sharp; no pseudobranchiæ. CHIASMODONTIDÆ.
AA. Gill-openings small, behind, above, or below the pectoral fins, which are more or less pediculate.
H. Gill-openings in or behind upper axil of pectoral; mouth small........OGCOCEPHALIDÆ.
HH. Gill-openings in or behind lower axil of pectoral; mouth large.
I. Head compressed; no pseudobranchiæ........ANTENNARIIDÆ.
II. Head depressed; pseudobranchiæ present........LOPHIIDÆ.

III.—VENTRAL FINS PRESENT, THORACIC OR JUGULAR, NUMBER OF RAYS NOT DEFINITELY I, 5.

A. Eyes unsymmetrical, both on the same side of head.
B. Eyes large, well separated; edge of preopercle usually evident........PLEURONECTIDÆ.
BB. Eyes small, very close together; edge of preopercle hidden by skin; mouth very small........SOLEIDÆ.
AA. Eyes symmetrical, one on each side of the head.
C. Ventral fin with or without spine, the number of soft rays more than 5.
D. Caudal fin wanting; scales spinous........MACROURIDÆ.
DD. Caudal fin well developed.
E. Ventral rays about 15; dorsal fin single, elevated........LAMPRIDIDÆ.
EE. Ventral rays I, 6 to I, 10; dorsal with spines.
F. Chin with two long barbels behind symphysis; dorsal continuous, with 5 spines........POLYMIXIIDÆ.
FF. Chin without barbels.
G. Dorsal fin divided, the anterior part of a single slender spine; ventrals elongate........BREGMACEROTIDÆ.
GG. Dorsal fin divided, the anterior part of many spines.
H. Body covered with firm serrated scales; anal spines 4; dorsal spines not elevated........HOLOCENTRIDÆ.
HH. Body naked or covered with small scales, besides bony plates or warts........ZEIDÆ.
GGG. Dorsal fin continuous, its spines 2 to 8........BERYCIDÆ.
CC. Ventral fin with or without spine, the number of soft rays fewer than 5.
I. Gill-opening before the pectoral fin.
J. Anal fin present; caudal fin not directed upward.
K. Upper jaw not prolonged into a sword.
L. Dorsal fin with some spines or simple rays.
M. Dorsal fin without soft rays, composed of spines only........BLENNIIDÆ.
MM. Dorsal fin with soft rays anteriorly, with spines posteriorly; gill-membranes joined to isthmus........ZOARCIDÆ.
MMM. Dorsal fin of spines anteriorly, with soft rays posteriorly.
N. Suborbital with a bony stay, extending across cheek, to or toward preopercle, the cheek sometimes entirely covered with a coat of mail........CEPHALACANTHIDÆ.
NN. Suborbital without bony stay.
O. Dorsal spines 2 to 4 only; head very broad, depressed; gills 3; gill-membranes broadly united to the isthmus.
P. Ventrals each a strong spine; teeth incisor-like; scales shagreen-like........TRIACANTHIDÆ.
PP. Ventrals not reduced each to a single spine........BATRACHOIDIDÆ.
OO. Dorsal spines numerous; gills 4.
Q. Gill-membranes separate, free from the isthmus.
R. Body greatly elongate; lower jaw with a slit at base to permit free motion; lips not fringed.
S. Soft dorsal and anal with a distinct lobe anteriorly, distinct from spinous part........GEMPYLIDÆ.
SS. Soft dorsal and anal without anterior lobe, continuous with spinous part........LEPIDOPODIDÆ.
RR. Body moderately elongate; opercles and lips fringed; eyes superior........DACTYLOSCOPIDÆ.
QQ. Gill-membranes broadly united, attached to the isthmus or not........BLENNIIDÆ.
LL. Dorsal fins of soft rays only.
T. Breast with a large sucking disk between ventral fins........GOBIESOCIDÆ.
TT. Breast without sucking disk.
U. Lateral line and base of dorsal beset with prickles; skeleton very soft; body compressed........ICOSTEIDÆ.
UU. Lateral line unarmed.
V. Tail isocercal, the vertebral column pointed behind, the last vertebra very small; hypercoracoid not perforate; no pseudobranchiæ.
W. Caudal fin present........GADIDÆ.
WW. Caudal fin wanting........MACROURIDÆ.
VV. Tail not isocercal, truncate at base of caudal; hypercoracoid perforate.
X. Gill-membranes joined to the isthmus; pseudobranchiæ present........ZOARCIDÆ.
XX. Gill-membranes free from the isthmus.
Y. Ventral fins inserted below or before the eyes; pseudobranchiæ generally well developed........OPHIDIIDÆ.
YY. Ventral fins inserted below shoulder-girdle; no pseudobranchiæ........BROTULIDÆ.
KK. Upper jaw prolonged into a bony sword; dorsal fin long and high; size large........ISTIOPHORIDÆ.
JJ. Anal fin wanting; caudal fin distorted or directed upward; body ribbon-like; ventral fins each of a few slender rays........TRACHYPTERIDÆ.
II. Gill-opening behind the pectoral fin.
Z. Gill-opening above and behind pectoral; mouth small, low........OGCOCEPHALIDÆ.
ZZ. Gill-opening below and behind pectoral; mouth large, nearly vertical........ANTENNARIIDÆ.

IV.—Ventral Fins Wholly Wanting.

A. Premaxillary and maxillary wanting or grown fast to palatines; body greatly elongate, eel-shaped, gill-openings restricted to the sides; scales minute or wanting; scapular arch not attached to the skull. Eels.
B. Gill-openings well developed, leading to large interbranchial slits; tongue present; opercles and branchial bones well developed; scapular arch present.
C. Skin covered with rudimentary embedded scales, usually linear in form, arranged in small groups, and placed obliquely at right angles to those of the neighboring groups; pectorals and vertical fins well developed, the latter confluent about the tail; lateral line present; posterior nostril in front of eyes; tongue with its margins free .... Anguillidæ.
CC. Scales wholly wanting; eggs (so far as known) of moderate size, much as in ordinary fishes.
D. Tip of tail with a more or less distinct fin, dorsal and anal fins confluent around it; tail sometimes ending in a long filament; coloration almost always plain, brownish, blackish, or silvery, the fins often black-margined.
E. Posterior nostril without tube, situated entirely above the upper lip.
F. Tongue broad, largely free anteriorly and on sides; vomerine teeth moderate.
G. Pectoral fins well developed; body not excessively elongate; lower jaw not projecting; anterior nostril remote from eye .... Leptocephalidæ.
FF. Tongue narrow, adnate to the floor of the mouth or only the tip slightly free; vomerine teeth well developed, sometimes enlarged.
H. Jaws not attenuate and recurved at tip; gill-openings well separated; anterior nostril remote from eye.
I. Pectoral fin small or wanting .... Moringuidæ.
II. Pectoral fin well developed, skin thick; skeleton firm; snout moderate; tail not ending in a filiform tip. Murænesocidæ.
HH. Jaws long and slender, tapering to a point, recurved at tip; nostrils large, both pairs close in front of eye; gill-openings convergent forward, separate or confluent; pectorals and vertical fins well developed; membranes of fins thin, not enveloping the rays; skeleton well developed. Deep-sea eels .... Nemichthyidæ.
EE. Posterior nostril close to the edge of the upper lip; tongue more or less fully adnate to the floor of the mouth; teeth subequal .... Myridæ.
DD. Tip of tail without rays, projecting beyond the dorsal and anal fins (not filiform); posterior nostril on the edge of the upper lip; anterior nostril near tip of snout, usually in a small tube; tongue usually adnate to the floor of the mouth; coloration frequently variegated .... Ophichthyidæ.
BB. Gill-openings small, roundish, leading to restricted interbranchial slits; tongue wanting; pectoral fins (typically) wanting; opercles feebly developed; fourth gill-arch modified, strengthened, and supporting pharyngeal jaws. Murænidæ.
AA. Premaxillary and maxillary present, often immovably united to rest of cranium.
J. Gill-openings united in a single slit below throat; no pectoral fins; body eel-shaped .... Symbranchidæ.
JJ. Gill-openings not united in a longitudinal slit.
K. Body eel-shaped, ending in a long filament, longer than rest of body; no anal or caudal fin .... Stylephoridæ.
KK. Body not truly eel-shaped.
L. Gill-membranes broadly united to the isthmus, restricting the gill-openings to the sides.
M. Snout tubular, bearing the short, toothless mouth at the end; body mailed .... Syngnathidæ.
MM. Snout not tubular.
N. Dorsal fin single, of spines or undivided rays only .... Blenniidæ.
NN. Dorsal fins 2, the anterior of spines, the posterior of soft rays; body short and deep.
O. Spinous dorsal of 2 or 3 spines; scales rather large, rough or bony .... Balistidæ.
OO. Spinous dorsal of 1 or 2 spines; scales minute, rough, forming a velvety covering .... Monacanthidæ.
NNN. Dorsal fin continuous, of soft rays only.
P. Teeth in each jaw confluent into 1.
Q. Body compressed, rough .... Molidæ.
QQ. Body not compressed, spinous .... Diodontidæ.
PP. Teeth in each jaw confluent into 2.
R. Back broadly rounded .... Tetraodontidæ.
RR. Back with a sharp median ridge .... Canthigasteridæ.
PPP. Teeth separate; body enveloped in a bony box .... Ostraciidæ.
LL. Gill-membranes free from the isthmus.
S. Vent at the throat; vertical fins confluent; body elongate, almost eel-shaped .... Fierasferidæ.
SS. Vent posterior, not at the throat.
T. Caudal fin wanting; body naked, greatly elongate .... Trichiuridæ.
TT. Caudal fin present.
U. Upper jaw prolonged into a sword; size very large .... Xiphiidæ.
UU. Upper jaw not prolonged into a sword.
V. Belly with a series of bony scutes along its edge; body much compressed .... Clupeidæ.
VV. Belly not armed with scutes.
W. Body ovate, much compressed.
X. Scales small, cycloid, silvery .... Stromateidæ.
XX. Scales wanting; caudal peduncle very slender .... Icosteidæ.
WW. Body oblong or elongate, much longer than deep; gill-membranes broadly united; teeth present; dorsal fin of spines only, or the posterior half of soft rays, the anterior of spines .... Blenniidæ.

DESCRIPTIVE LIST OF FISHES KNOWN FROM PORTO RICO.

Family 1. BRANCHIOSTOMIDÆ. The Lancelets.

Body elongate, lanceolate, compressed, naked, colorless; fins represented by a low fold extending along back, with usually a rudimentary fold below, which passes by vent to the abdominal pore. Mouth inferior, appearing as a longitudinal fissure, surrounded by conspicuous, rather stiff, cirri. Eye rudimentary. Liver reduced to a blind sac of the simple intestine.

Small, translucent creatures found embedded in sand on warm coasts throughout the world. Eight species are now recognized, referable to two or three genera, all very similar in appearance and habits. The numbers of the muscular impressions furnish the only characters thus far known by which the species can be distinguished.

a. Gonads (reproductive structures) present on both sides of the median line; anal fin present, with traces of fin-rays; no caudal process .... BRANCHIOSTOMA, 1
aa. Gonads present on right side only; anal fin without fin-rays or successive fin-ray chambers; a long caudal process or tail, about as long as head .... ASYMMETRON, 2

Genus 1. BRANCHIOSTOMA Costa. Amphioxus.

Lancelets with the gonads present on both sides of median line. Anal fin present, with traces of rays. Vertebral column not produced backward into a caudal process.

Six or seven species recognized, found in warm seas, usually buried in sand flats at no great depth. Very tenacious of life and enduring considerable mutilation. Of the three American species, only one is known from Porto Rico.

a. Myocommata or muscular bands 58 to 64.
b. Myocommata behind vent 11 to 13, the formula usually 35+14+12=61 .... *lanceolatum*
bb. Myocommata behind vent 7 to 10, the formula usually 35+14+9=58 .... *caribæum*, 1

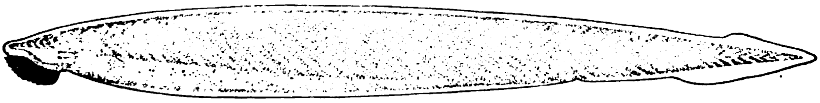

FIG. 1.—*Branchiostoma caribæum.*

1. Branchiostoma caribæum Sundevall. *West Indian Lancelet.*

Muscular bands (myocommata) usually 35 + 14 + 9 = 58; gonads 22 to 26 on each side; tail short; extremities attenuate. Usual length 1.75 inches.

In shallow waters, buried in the sand, from Beaufort, N. C., to the mouth of the La Plata; abundant off the Carolina coast and in localities in Florida (Port Tampa), Jamaica, Brazil, etc.

In the white coral sand at the east end of the island of Porto Rico, at a depth of 10 to 15 fathoms, this interesting little species was fairly abundant. About 40 specimens were obtained at stations 6084, 6086, 6087, 6093, and 6097, mostly at station 6084. The first four of these stations are between Vieques and Culebra islands and the last is off Hucares about 5 miles. The bottom at all was of live coral and white sand. One specimen (station 6086) was obtained in the dredge, while all the others were caught in the tangle. In many cases the lancelets were still alive when picked out from the meshes of the tangle, though they had been subjected to considerable rough treatment. The majority do not exceed an inch in length, and the largest is but 1.25 inches long. These are considerably smaller than the numerous individuals collected by the *Fish Hawk* off Port Tampa, Fla., in 1898.

Branchiostoma caribæum Sundevall, Ölfers, Vet. Akad. Forhandl., 12, 1853, St. Thomas; Jordan & Evermann, Fishes of North and Middle America, 3, 1896.

Genus 2. ASYMMETRON Andrews.

Gonads, or reproductive structures, developed on the right side only. Anal fin without fin rays or successive fin-ray chambers. A long caudal process. Otherwise as in *Branchiostoma*. One species.

2. Asymmetron lucayanum Andrews. *Bahama Lancelet.*

Right metapleuron continuous with median ventral (anal) fin, which passes to right of anus. Preoral hood extensive, the cirri united by the membrane throughout greater part of their length, and smooth, without sensory papillæ. Gonads on the right, 29, extending from fifteenth to forty-third myotomes inclusive. Myotome formula 44+9+13=66. Length ½ inch. Adult and young swimming at surface in the evening in June and July at Bemini and Nassau, Bahamas; also taken buried in calcareous sand. (*Andrews.*) Three specimens, somewhat less than 0.75 inches in length, taken in the dredge and tangle at Fish Hawk stations 6086 and 6093, off Culebra, in 14.75 and 15 fathoms respectively, and 6097, off Humacao, in 10 fathoms. These are decidedly larger than specimens in the U. S. National Museum collected by Dr. Andrews.

Asymmetron lucayanum Andrews, Studies Biol. Lab. Johns Hopkins Univ., V, 237, 1893, Bemini, Bahamas; Jordan & Evermann, l. c., 4, 1896.

Family II. GINGLYMOSTOMIDÆ. The Nurse Sharks.

Large sharks with general characters of *Scylliorhinidæ*, but with tail very long and more or less abruptly bent upward at its base, as in the *Galeidæ*. First dorsal above or behind ventrals, the second opposite or rather before anal; eyes very small, with small spiracles behind them; nostrils confluent with mouth; nasal valves on both sides forming a quadrangular flap in front of mouth, each being provided with a free cylindrical cirrus; an upper and lower lip, the latter not extending across symphysis; fourth and fifth gill-openings close together.

Large sharks of the warm seas; genera 3, species about 5.

Genus 3. GINGLYMOSTOMA Müller & Henle.

Characters of the genus included above.

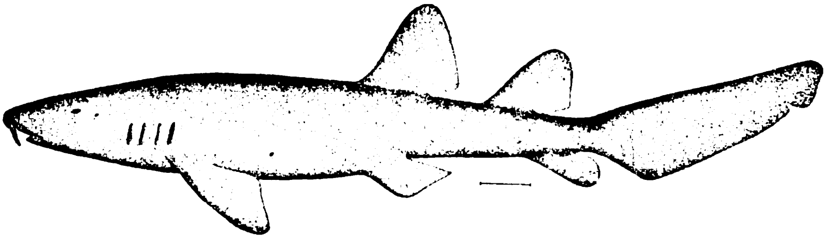

FIG. 2.—*Ginglymostoma cirratum.*

3. Ginglymostoma cirratum (Gmelin). *Nurse Shark; "Gata."*

Head obtuse, depressed; nasal cirrus reaching lower lip; angles of fins obtusely rounded; tail forming nearly one-third of total length; skin very thick; uniform brownish, the young with small, scattered, round black spots.

A large shark of the warmer parts of the Western Hemisphere, abundant about coral reefs in the West Indies and on the west coast of Mexico, and occasionally on our South Atlantic coast. Length 6 to 10 feet. Not seen by us in Porto Rico, but included on the authority of Professor Poey.

Squalus cirratus Gmelin, Syst. Nat., I, 1492, 1788, American Seas; after Broussonet.

Squalus punctatus Bloch & Schneider, Syst. Ichth., 134, 1801, Cuba; after Gata Hispanas of Parra.

Squalus punctulatus Bloch & Schneider, l. c., 549, 1801, Cayenne; after *Squale pointille* of Lacépède.

Squalus argus Bancroft, Zool. Jour., V, 82, 1832-1834, West Indies.

Ginglymostoma fulvum Poey, Memorias, II, 342, 1861, Havana; Poey, Fauna Puerto-Riqueña, 349, 1881; Stahl, Fauna de Puerto Rico, 81 and 167, 1883.

Ginglymostoma caboverdianus Capello, Jour. Sci. Phys. Lisb. 1867, 167, Cape Verde.

Ginglymostoma cirratum, Jordan & Evermann, l. c., 26, 1896.

Family III. GALEIDÆ. The Requiem Sharks.

Sharks with two dorsal fins, first short and high, entirely before ventrals; second comparatively small, opposite anal; no spines; gill-openings moderate, the last above base of pectoral; tail more or less bent upward from base of caudal fin; sides of tail not keeled; eyes with nictitating membranes; head not hammer-shaped, the snout being longitudinally produced, as usual among sharks. Spiracles small or obsolete. Ovoviviparous.

A large family of 20 or more genera and about 60 species; found in all seas. The species are often closely related and difficult of determination. Of 11 genera recognized by Jordan & Evermann as occurring in American waters, only one is as yet known from Porto Rico.

GALEINÆ:
a. Teeth flat and paved, without cusps or ridges; spiracles present; no pit at root of tail; labial folds well developed.
b. Embryo not attached to uterus by a placenta; teeth very blunt .... MUSTELUS
aa. Teeth more or less compressed, with entire or serrate sharp edges.
GALEORHININÆ:
c. Spiracles present.
d. Root of tail with conspicuous pit above; teeth all coarsely serrate, alike in both jaws and each with a deep notch on outer margin; caudal fin with a double notch .... GALEOCERDO
CARCHARHININÆ:
cc. Spiracles obsolete; lower teeth narrower than upper teeth.
e. Angle of mouth without groove or with merely a slight depression, which does not extend along either jaw.
f. First dorsal inserted anteriorly, nearer ventrals than pectorals; embryo (so far as known) attached to uterus by a placenta.
g. Teeth all serrate more or less, often entire in the very young .... CARCHARHINUS, 4
gg. Teeth of upper jaw serrate at base only; lower teeth entire, erect .... HYPOPRION
ggg. Teeth all entire at all ages, and nearly all erect .... APRIONODON
ee. Angle of mouth provided with a more or less distinct groove which extends along one or both jaws; teeth entire, or very nearly so, more or less obliquely placed, their points turned away from median line; embryo (so far as known) with a placenta .... SCOLIODON

Genus 4. CARCHARHINUS Blainville.

Body rather robust; head broad and depressed; mouth inferior, with teeth in both jaws strongly serrated in adult, less so or entire in young, those in upper jaw broad or narrow, those below narrow, straight, and nearly erect. No spiracles. First dorsal large, not far behind pectorals; pectoral falcate; second dorsal small. Embryos attached by placenta to uterus, as in *Scoliodon*, *Triakis*, and *Galeus*.

Voracious sharks of the warm seas. Species very numerous and difficult of separation.

a. Teeth in both jaws distinctly serrate in adult; serræ on lower teeth smaller; upper teeth rather broad, lower teeth narrower; snout not very acute.
PLATYPODON:
b. Upper teeth oblique, deeply notched on outer margin; lower teeth narrow, scarcely or not notched.
c. Pectoral very large, 3 times as long as broad, falciform, extending beyond base of first dorsal; color blue-gray .... *obscurus*
cc. Pectoral shorter, not 3 times as long as broad, extending little if any beyond base of first dorsal.
d. Length of snout from mouth little if any greater than width of mouth.
e. Distance from end of base of first dorsal to ventrals less than length of base of first dorsal.
f. Nasal flap without sharp lobe; second dorsal and anal nearly equal; color blue-black .... *falciformis*, 4
ff. Nasal flap with an acute lobe.
g. Snout not very short, its length from the mouth not notably less than the width of mouth; color yellowish-brown .... *acronotus*
gg. Snout very short and blunt, its length from mouth but two-thirds width of mouth .... *perezi*
ee. Distance from end of base of first dorsal to ventrals greater than length of first dorsal; snout moderate .... *remotus*
dd. Length of snout from mouth greater than width of mouth; first dorsal small .... *henlei*
CARCHARHINUS:
bb. Upper teeth triangular, suberect, scarcely notched on the outer margin; lower teeth similar but much narrower.
h. Snout moderate, its length from mouth about equal to width of mouth .... *milberti*
hh. Snout very short, its length from mouth less than width of mouth.
i. Pectoral long and falcate, reaching to posterior part of base of dorsal. Anterior margin of first dorsal convex, height of fin about equal to depth of body .... *lamia*
ii. Pectoral fin moderate, scarcely falcate, not reaching to end of base of dorsal; second dorsal not larger than anal; length of snout from mouth 1.5 times in breadth of mouth; upper teeth very broad .... *platyodon*
ISOGOMPHODON:
aa. Teeth slightly serrated, similar in form in the two jaws, narrow, claviform, constricted at base; snout rather sharp.
j. Snout moderate, its length from mouth not greater than breadth of mouth; teeth moderate; fins edged with black .... *limbatus*, 5
jj. Snout very long and narrow, its length from mouth twice distance between nostrils; teeth small, about 48 in each jaw .... *oxyrhynchus*

4. **Carcharhinus falciformis** (Bibron). "*Cazón de Playa.*"

Snout moderately prolonged and acute; nostrils without lobe; first dorsal rather backward; second dorsal and anal opposite each other and of medium size; pectoral not twice as long as broad; upper teeth with a marked reentrant angle on outer border; two pores of nape well marked.

Color, blue-black, deeper than in any other species.

Two specimens, taken on a hook off the Morro at San Juan January 13, measured as follows:

Measurements.	No. 0298.		No. 0299.	
	Ft.	*In.*	*Ft.*	*In.*
Total length	3	3	7	4
Length to base of caudal	2	4	5	6
Tip of snout to first gill-opening		8	......	......
Length of caudal fin from pit		11.5	2	1
Length of pectoral fin		6	1	4
Tip of snout to mouth		3.5		5.5
Width of mouth		3		7.5
Snout to origin of dorsal	1	1.5	2	6
Origin of dorsal to caudal pit	1	4	......	......

No. 0299 possessed the following characters: Snout gently and narrowly rounded; first dorsal far in advance of ventrals, its height 9 inches, its base 11 inches; pectoral falcate, inner rays little produced; second dorsal and anal opposite, equal in size; ventrals small, claspers 10 inches long; lower lobe of caudal about one-third length of upper, which is somewhat falcate.

Color, olivaceous, paler below.

Though we were constantly on the lookout for sharks and often had lines out trying for them, this is the only species obtained by us in Porto Rico, and only these two specimens were seen. They are probably more abundant at other seasons.

Carcharias falciformis Bibron, in Müller & Henle's Plagiostomen, 47, 1838, Cuba.
Squalus tiburo Poey, Memorias, II, 331, 1861, Havana.
Carcharinus falciformis, Jordan & Evermann, l. c., 36, 1896.

5. **Carcharhinus limbatus** (Müller & Henle). *Caçonetta.*

Snout somewhat pointed in front, rather produced, distance between its extremity and mouth somewhat less than width of mouth; nostrils nearly midway between extremity of snout and mouth; teeth $\frac{25-29}{27-30}$, similar in form in both jaws, erect, constricted, on a broad base, upper more distinctly serrated than lower; gill-openings wide, at least twice as wide as the small eye. Pectorals falciform, extending beyond end of dorsal, length of their upper margin nearly four times that of lower. First dorsal commencing very close behind axil of pectoral; origins of second dorsal and anal opposite each other, the bases being nearly equally long. Caudal fin long, its length equal to distance between origins of the two dorsal fins.

Color, gray, lower side of extremity of pectoral, extremities of second dorsal and anal, and of lower caudal lobe, black. (Günther).

Found in tropical seas, north to Florida; numerous specimens once taken at Woods Hole, Mass.; common in Brazil; used as food by the very poor. Not seen by us in Porto Rico, but recorded from there by Doctor Stahl.

Carcharias (Prionodon) limbatus Müller & Henle, Plagiostomen, 49, 1838, Martinique.
Isogomphodon maculipinnis Poey, Repertorio, I, 191, pl. 4, figs. 2 and 3, 1867, Cuba.
Carcharias mulleri Steindachner, Sitzb. Akad. Wiss. Wien 1867, 356, West Indies.
Carcharias microps Lowe, Proc. Zool. Soc. 1840, 38, Madeira.
Prionodon cucuri Castlenau, Anim. Nou. Rares. Amer. Sud, Poiss., 99, 1855, Bahia.
Platypodon ? Poey, Fauna Puerto-Riqueña, 348, 1881.
Platypodon maculipinnis, Stahl, l. c., 81 and 167, 1883.
Carcharhinus limbatus, Jordan & Evermann, l. c., 40, 1896.

Family IV. SPHYRNIDÆ. The Hammer-head Sharks.

General characteristics of the *Galeidæ*, but with the head singularly formed, kidney-shaped, or hammer-shaped, from extension of its sides, the nostrils being anterior and the eyes on the sides of the hammer; mouth crescent-shaped, under hammer; teeth of both jaws similar, oblique, each with a notch on the outside near base; no spiracles; last gill-opening over pectoral; first dorsal and pectorals large, the dorsal nearer pectorals than ventrals; second dorsal and anal small; a pit at root of caudal; caudal fin with a single notch toward its tip, its lower lobe developed.

One genus, with 5 species, inhabiting most warm seas. Large sharks, known at once by the singular form of the head, which is not quite the same in any two species.

Genus 5. SPHYRNA Rafinesque.

Characters of the genus included above. In form of head there is a perfect gradation among the species from a narrow hammer, with the lobes three times as long as broad and deeply grooved along the anterior edge, to kidney shape, in which the anterior grooves are obsolete. Only one species of this genus is known from Porto Rico.

a. Nostrils near eyes.
b. Nostril with frontal groove short or obsolete; lateral extension of head moderate, so that the head is rather kidney-shaped than hammer-shaped.
RENICEPS:
c. Nostril with groove obsolete; anterior and lateral margins of head confluent into a semicircle............... *tiburo*
PLATYSQUALUS:
cc. Nostril with a short groove; anterior margin of head curved, not continuous with lateral edges.............. *tudes*
SPHYRNA:
bb. Nostril with a well-developed groove, which extends along front of the hammer-shaped head, the anterior and posterior outlines of which are nearly parallel.. *zygæna*, 6

6. Sphyrna zygæna (Linnæus). *Hammer-head Shark; "Cornuda."*

Head truly hammer-shaped; width of head about twice its length; length of hinder margin of hammer nearly equal to its width near eye, prolonged into a groove which runs along nearly the whole front margin of head; first dorsal large, second quite small, smaller than anal; pectoral rather large. Color, gray. A large, voracious shark, reaching a length of 15 feet or more; found in all warm seas; occasional on our coasts from Cape Cod and from Point Concepcion southward. Not obtained by us, but included on the authority of Professor Poey.

Squalus zygæna Linnæus, Syst. Nat., ed. X, 234, 1758, Europe; America.
Cestracion zygæna, Poey, Fauna Puerto-Riqueña, 348, 1881; Stahl, Fauna de Puerto Rico, 81 and 167, 1883.
Sphyrna zygæna, Jordan & Evermann, l. c., 45, 1896.

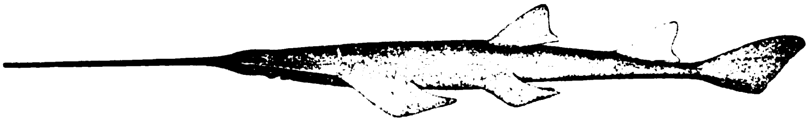

FIG. 3.—*Pristis pectinatus.*

Family V. PRISTIDÆ. The Saw-fishes.

Body elongate, depressed; pectoral fin moderate, front margin quite free, not extending to head; snout produced into a very long, thin, flat blade, armed with series of strong tooth-like processes placed in sockets along each edge; teeth in jaws minute, obtuse; gill-openings moderate, inferior; spiracles wide, behind eye; nostrils inferior, no tentacles; no nictitating membrane; dorsal fins large, without spine, the first nearly opposite ventrals. Caudal well developed, bent upward, a fold along each side of tail.

A single genus, with five or more species, inhabiting warm seas on sandy shores, sometimes ascending rivers.

Genus 6. PRISTIS Latham.

Characters of genus included above.

a. Rostral teeth in 18 to 20 pairs; first dorsal chiefly before ventrals; caudal with a small lower lobe........ *perrotteti*
aa. Rostral teeth in 24 to 32 pairs; first dorsal opposite ventrals; caudal without lower lobe............... *pectinatus*, 7

7. **Pristis pectinatus** Latham. *Common Saw-fish; "Pez Sierra."*

First dorsal over ventrals; second dorsal scarcely smaller than first; no lower caudal lobe. Saw with 24 to 32 pairs of teeth, the posterior farther apart than the anterior. Found in the tropical seas north to West Indies and Florida; abundant in the Gulf of Mexico, ascending the Lower Mississippi. The species probably reaches a length of 20 feet. Not obtained by us, but included on the authority of Professor Poey.

The saw-fish is abundant in Indian River, Florida, where it is permanently resident. It is held in much dread by the commercial fishermen on account of the damage which it does by becoming entangled in their nets. The larger ones tear or cut the nets so seriously as to render them valueless, while the smaller ones become entangled and can only be removed with great difficulty. Those seen in Indian River usually do not exceed 3 feet in length, the saw included, but very large ones are occasionally taken. It is said that one caught near Eau Gallie in October, 1895, was 12.5 feet long and weighed 425 pounds. The largest reported by fishermen were 16 or 17 feet long.

Some interesting information concerning the young of the saw-fish is recorded. Mr. F. B. Everett says that from a large female saw-fish he took a number of young which swam away when placed in the water. The "saws" were enveloped in a membrane which soon disappeared in specimens left to dry in the sun, and the teeth became visible. Mr. Stypmann, of Stuart, Fla., took 18 or 20 young from a saw-fish about the 1st of July. The "saws" were well developed, but they, like the teeth, were soft like leather. There is some variation in the number of teeth on the saw, and there is usually one more tooth on one side than on the other. From a large number counted it appears that the usual numbers are 25 and 26, respectively.

Another species of saw-fish (*Pristis perrotteti* Valenciennes) was described in 1838 from the Senegal River, on the west coast of Africa. This is said to occur in the West Indies, and the saw-fish from the Pacific coast of America north to Mazatlan has been identified with it. The Pacific coast species, however, is now regarded as distinct, and has been named *Pristis zephyreus* Jordan & Starks. No direct comparison has been made between specimens from the west coast of Africa and the West Indies, and it may be that there is but the one species in the West Indies.

Pristis pectinatus Latham, Trans. Linn. Soc., II, 278, 1794, "in the ocean"; Poey, Fauna Puerto-Riqueña, 349, 1881; Stahl, l. c., 81 and 167, 1881; Jordan & Evermann, l. c., 60, 1896.
Pristis granulosa Bloch & Schneider, Syst. Ichth., 352, 1801, Havana; after Parra.
Pristis mississippiensis Rafinesque, Ichth. Ohi., 80, 1820, Lower Mississippi River
Pristis megalodon Duméril, Elasmobranches, 476, pl. 9, fig. 4, 1870, Cayenne.
Pristis acutirostris Duméril, l. c., 479, 1870, Martinique.

Family VI. DASYATIDÆ. The Sting Rays.

Disk usually more or less broad than long; pectoral fins uninterruptedly confluent in front, forming tip of snout; tail variously formed, usually whip-like, sometimes short and stout, sometimes bearing a single dorsal or caudal fin, but never with two dorsals; usually one or more vertical folds of skin on the tail, rarely a lateral fold. Tail generally armed with a large, sharp, retrorsely serrate spine on its upper surface toward the base; 2 or 3 spines occasionally present. Ventral fins not emarginate. Skin smooth or variously prickly or spinous, roughest in adult; no differentiated spines on pectorals in males, the sexes being similar. Mouth rather small; teeth small, paved, usually more or less pointed or tubercular. Nostrils close together; nasal valves forming a rectangular flap, which is joined to upper jaw by a narrow frenum. Spiracles large, placed close behind eyes. Skull not elevated, spiracles and eyes superior. Ovoviviparous.

Found in most warm seas, some of them in the fresh waters of the northern parts of South America. Genera about 10; species 50. The large jagged spine on the muscular tail is capable of inflicting a severe and even dangerous wound. Only two species of this family are as yet known from Porto Rico, though doubtless others will be found.

a. Tail stout, provided with a rayed caudal fin; no dorsal fin; disk roundish; caudal spine strong .... UROLOPHUS
aa. Tail slender, without caudal fin; pelvis without sword-shaped process. (Marine species.)
DASYATINÆ:
b. Tail whip-like, longer than disk, which is rhomboid or roundish; caudal spine strong .... DASYATIS, 7
bb. Tail very short, shorter than the very broad, transversely rhombic disk; caudal spine weak, often wanting. No trace of dorsal fin .... PTEROPLATEA

Genus 7. DASYATIS Rafinesque.

Disk oval, flat, with rounded angles. Tail very long and slender, whip-like, without fin, but often with 1 or 2 vertical membranous folds; a strong, serrated spine toward base of tail. Skin more or less spinous or prickly, rarely smooth. Teeth small, paved; a few papillæ usually present in mouth behind lower jaw.

This genus contains about 30 species; sting rays of large size abundant in warm seas. Many of the spinous species are nearly or quite smooth when young, becoming rough with age. Some of our species are yet imperfectly known and much of the synonymy is uncertain.

HEMITRYGON:
  a. Tail with a keel or wing-like expansion below only; adult with stout bucklers on back and tail; tail rough, more than twice length of disk .... *centrura*
DASYATIS:
  aa. Tail with a narrow keel or expansion both above and below.
    b. Tail simply keeled above, with a wing-like expansion below.
      c. Shoulder with 3 series of tubercles; tail less than twice length of disk .... *hastata*, 8
      cc. Shoulder with fewer than 3 series of tubercles.
        d. Tail round, more than twice disk; back with strong tubercles; snout sharp .... *gymnura*
    bb. Tail more or less compressed, with a wing-like expansion above, a larger one below.
      e. Skin more or less prickly in adult, with a median series of tubercles on back .... *sabina*
      ee. Skin nearly or quite smooth in adult; median line of back not prickly or with but one spine .... *say*, 9

8. **Dasyatis hastata** (DeKay). *Sting Ray; "Raya."*

Disk quadrangular, about one-fourth wider than long; anterior margins nearly straight, meeting in a blunt angle on end of snout, curved near outer angle to meet slightly convex posterior margins; inner border convex; outer and hinder angles rounded. Ventrals almost entirely covered by pectorals, their hinder margins convex. Tail more than one and one-half times length of disk, low-keeled on upper side, a long, broad, membranous expansion below, roughened with small asperities; one or more serrated spines. Body smooth in young; very old with scattered, small asperities; a row of narrow compressed tubercles along middle of back and on base of tail; points of tubercles depressed and directed backward. On each shoulder, parallel with median row, is a shorter row, its length varying according to age. Mouth with 3 papillæ. Jaws with more curvature than those of *D. centrura* and less than those of *D. sabina;* young without tubercles. Color, bluish or olivaceous-brown, pale below.

West Indies to Brazil; north to Florida. One female obtained at Hucares, whose length (of disk) is 11.25 inches; tail, 15.5 inches; width of disk, 14.5 inches; a row of 12 spines along middle line of back and a shorter lateral row of 2 or 3 spines on each side.

Trygon hastata DeKay, New York Fauna: Fishes, 373, pl. 65, fig. 214, 1842, Rhode Island.
Dasyatis hastata, Jordan & Evermann, l. c., 83, 1896.

9. **Dasyatis say** (Le Sueur). *Southern Sting Ray; "Raya."*

Disk quadrangular, one-sixth wider than long, anterior margins nearly straight, posterior and inner borders convex, outer and posterior angles rounded. Snout not protruding beyond lines of margins. Ventrals rounded. Tail strong, rather more than one and one-half times length of disk, with a strong serrated spine, bearing a short, low, cutaneous expansion behind spine on upper side, and a longer, little wider one below, ending nearly opposite. Upper jaw undulated, lower prominent in middle. Teeth small, smooth in young and females, sharp in adult males; 3 papillæ at bottom of mouth, and 1 at each side. Body and tail smooth.

Color, olive-brown in adult, reddish or yellowish in young; lower surface whitish.

This species closely resembles the European *D. pastinaca.* In *D. say* the anterior margins form a more blunt angle at end of snout, which is less prominent at apex; outer and posterior extremities of pectoral rounder, posterior margin more convex, disk broader toward ventrals, and tail longer; in *D. pastinaca* the lateral and hinder angles of pectoral and lateral angle of ventral are marked by blunted corners; a single small, rounded tubercle on middle of back.

This ray is found from Carolina to Brazil. It is quite common in Florida, and is occasionally taken as far northward as New York. Not obtained by us, but given on authority of Poey.

Raja say Le Sueur, Jour. Ac. Nat. Sci. Phila., I, 1817, 42, New Jersey.
? *Trygon sayi*, Poey, Fauna Puerto-Riqueña, 350, 1881; Stahl, l. c., 81 and 167, 1883.
Dasyatis say, Jordan & Evermann, l. c., 86, 1896.

Family VII. MYLIOBATIDAE. The Eagle Rays.

Disk broad; pectoral fins not continued to end of snout, but ceasing on sides of head and reappearing in front of snout as one or two fleshy protuberances (cephalic fins), which are supported by fin rays. Tail very long and slender, whip-like, with a single dorsal fin near its root, behind which is usually a strong retrorsely serrated spine. Nasal valves forming a rectangular flap, with posterior margin free, attached by a frenum to upper jaw. Skull less depressed than usual among rays, its surface raised so that the eyes and spiracles are lateral in position. Teeth hexangular, large, flat, tessellated, middle ones usually broader than the others. Skin smooth; no differentiated spines on pectorals in males, the sexes being similar. Ventrals not emarginate. Ovoviviparous.

Only a single species of this family is yet known from Porto Rico.

AETOBATINÆ:
a. Teeth in a single series, very broad; muzzle entire .... AETOBATUS, 8
RHINOPTERINÆ:
aa. Teeth in several series, the middle series very broad.
b. Muzzle entire .... MYLIOBATIS
bb. Muzzle emarginate; cephalic fins below level of disk .... RHINOPTERA

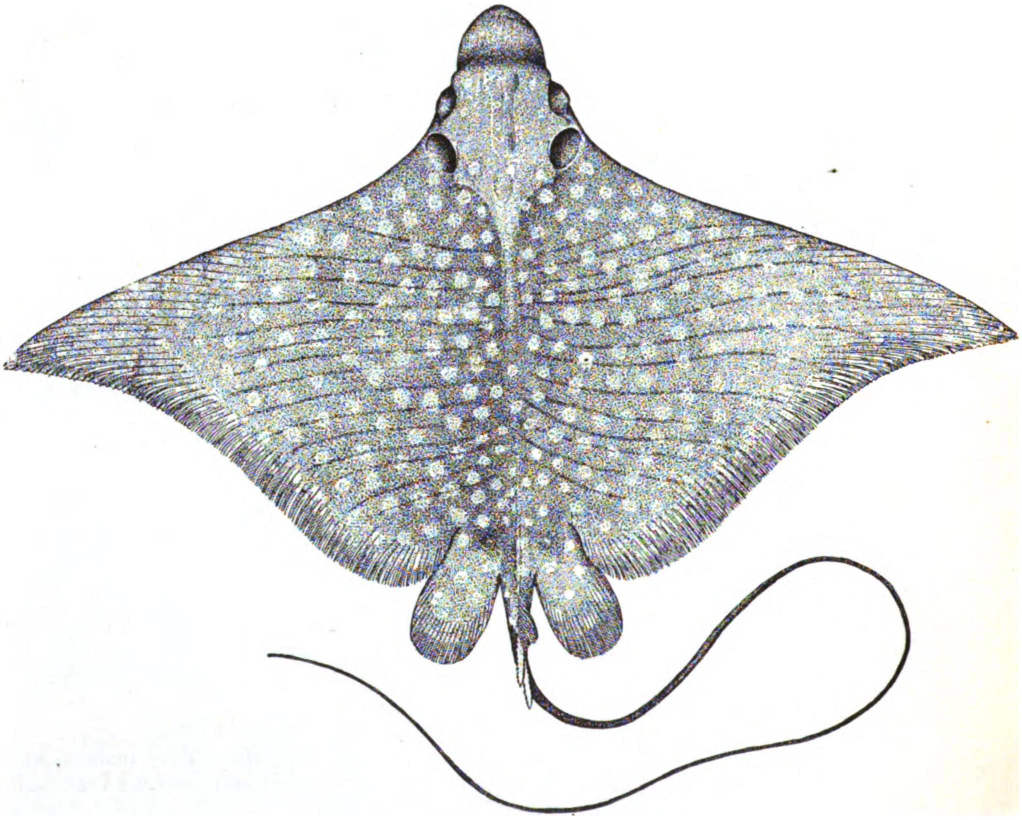

FIG. 4.—*Aetobatus narinari*, dorsal view.

Genus 8. AETOBATUS Blainville.

General form of *Myliobatis*. Muzzle entire. Teeth flat, broad, forming a single series corresponding to the middle series in *Myliobatis*, there being no small lateral teeth. Upper dental lamina straight, lower curved and projecting beyond upper. Free border of nasal valve deeply emarginate. Skin smooth. Found in tropical seas.

10. Aetobatus narinari (Euphrasen). *Spotted Sting Ray; "Obispo"; "Chucho."*

Disk nearly or quite twice as broad as long; tail very long, about 2.5 times length of disk; snout 7 in length of disk; distance from snout to eye 10 in width of disk; width of mouth 10 in length of disk. A long furrow in middle of interorbital space, deepest in front; spiracles obliquely placed.

General color of whole upper surface light chocolate-brown, everywhere covered with roundish or oblong pearly or bluish spots or blotches, largest about size of eye, smallest less than half as large; under surface milky-white except margin of snout, which is dark-gray; tail uniform chocolate-brown; iris yellowish-gray.

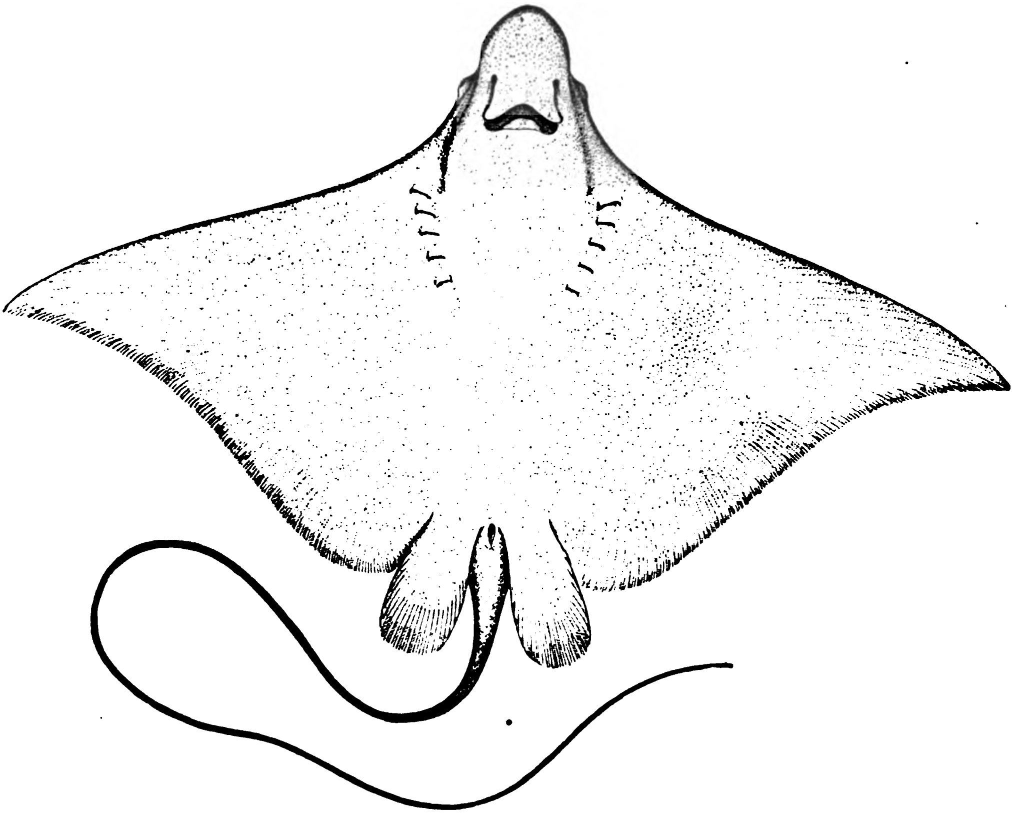

Fig. 5.—*Aetobatus narinari*, ventral view.

Found in tropical seas; north on our Atlantic coast to Virginia. One male seined at Culebra Island February 9. This is one of the largest and most interesting of the rays. It is not uncommon on our Florida coast, though the published records do not so indicate. It attains a length of 2 feet or more exclusive of the tail, which is two to three times the length of the disk.

Raia narinari Euphrasen, Vet. Ak. Nya. Handl., XI, 1790, 217, Brazil; after *Narinari* of Marcgrave.
Myliobatis eellenkee Rüppell, Neu. Wirb., 70, 1835, Red Sea.
Goniobatis macroptera McClelland, Calcutta Jour. Nat. Hist., I, 1841, 60, Bengal.
Aetobatus narinari, Poey, Fauna Puerto-Riqueña, 349, 1881; Stahl, l. c., 81 and 167, 1883; Jordan & Evermann, l. c., 88, 1896.

Family VIII. ANGUILLIDÆ. The True Eels.

The true eels are characterized by their scaly skin in association with a conical head and a general resemblance to the congers.

Genus 9. ANGUILLA Shaw.

Body elongate, compressed behind, covered with embedded linear scales placed obliquely, some at right angles to others. Lateral line well developed. Head long, conical, moderately pointed, the rather small eye well forward and over angle of mouth. Teeth small, subequal, in bands on each jaw and a long patch on vomer. Tongue free at tip. Lips rather full, with free margin behind, attached by a frenum in front. Lower jaw projecting. Gill-openings rather small, slit-like, about as wide as base of pectorals and partly below them. Nostrils superior, well separated, the anterior with a slight tube. Vent close in front of anal. Dorsal inserted at some distance from head, confluent with anal around tail. Pectoral well developed.

Found in most warm seas (the eastern Pacific excepted), ascending streams, but mostly spawning in the sea. They often move for a considerable distance on land, in damp grass, and in this way pass waterfalls, dams, and other obstructions. It is thought that they spawn only in the sea, the female dying after having once produced ova. The females are larger than the males, paler in color, with smaller eyes and higher fins. Eels are among the most voracious of fishes. "On their hunting excursions they overturn alike huge and small stones, beneath which they find species of shrimp and crawfish, of which they are excessively fond. Their noses are poked into every imaginable hole in their search for food, to the terror of innumerable small fishes."

11. **Anguilla chrysypa** Rafinesque. *"Anguilla"; Common Eel.*

(PLATE 1.)

Head 3.2 in trunk; depth 5.8; eye 1.8 in snout; snout 5.5 in head; interorbital 5.4.

Body elongate, compressed behind, covered with linear embedded scales obliquely placed in groups, the scales of which are at right angles to those of adjoining groups; lateral line well developed; head long, conic, pointed; eye situated over angle of mouth; lower jaw projecting; fine conic teeth in bands on each jaw and on vomer; the gill-openings are vertical slits in front of and partly below pectoral; dorsal inserted far back of head, but considerably in front of vent; anal commencing shortly behind vent, confluent with dorsal around the tail, forming a caudal fin.

Atlantic coast of the United States, and Mississippi Valley; abundant from Maine to Mexico, ascending all rivers south of Canada and east of the Rocky Mountains. Common in the West Indies and highly valued as a food-fish. It is caught in considerable numbers in Porto Rico in the small bamboo traps or "nasas" set in the small rivers.

Six examples, the smallest 4 inches long, the largest over 2 feet, from San Juan market and Bayamon River at Bayamon, the smallest one from the sea at Mayaguez.

Anguilla chrysypa Rafinesque, Amer. Month. Mag. and Crit. Rev. 1817, 120, Lake George; Hudson River; Lake Champlain; Jordan & Evermann, l. c., 348, 1896.
Anguilla blephura Rafinesque, Amer. Month. Mag. and Crit. Rev. 1817, 120, Long Island.
Anguilla laticauda Rafinesque, Amer. Month. Mag. and Crit. Rev. 1817, 445, Ohio River.
Anguilla aterrima Rafinesque, Ich. Ohiensis, 78, 1820, Tennessee and Cumberland rivers.
Anguilla xanthomelas Rafinesque, Ich. Ohiensis, 78, 1820, Ohio River.
Anguilla lutea Rafinesque, Ich. Ohiensis, 78, 1820, Ohio River.
Muræna rostrata Le Sueur, Jour. Ac. Nat. Sci. Phila. 1821, 81, Cayuga Lake, New York.
Muræna bostoniensis Le Sueur, Jour. Ac. Nat. Sci. Phila. 1821, 81, Boston.
Muræna serpentina Le Sueur, Jour. Ac. Nat. Sci. Phila. 1821, 82, Newport, R. I.
Muræna macrocephala Le Sueur, Jour. Ac. Nat. Sci. Phila. 1821, 82, Saratoga, N. Y.
Muræna argentea Le Sueur, Jour. Ac. Nat. Sci. Phila. 1821, 82, Boston Bay.
Anguilla tenuirostris De Kay, Fishes New York, 310, 1842, New York.
Anguilla novæorleanensis Kaup, Apodes, 43, fig. 33, 1856, New Orleans, La.
Anguilla punctatissima Kaup, Apodes, 41, 1856, Niagara River.
Anguilla cubana Kaup, Apodes, 44, 1856, Cuba.
Anguilla novæterræ Kaup, Apodes, 45, fig. 35, 1856, Newfoundland.
Anguilla texana Kaup, Apodes, 45, fig. 36, 1856, Texas.
Anguilla wabashensis Kaup, Apodes, 46, 1856, Wabash River.
Anguilla tyrannus Girard, U. S. and Mexican Bound. Surv., 75, 1859, Rio Grande.
Muræna anguilla, Poey, Fauna Puerto-Riqueña, 344, 1881.
Muræna cubana, Stahl, l. c., 166, 1883.

Family IX. LEPTOCEPHALIDÆ. The Conger Eels.

This family includes those eels which are scaleless, and have the tongue largely free in front; body moderately elongate, end of tail surrounded by a fin; posterior nostril remote from upper lip and near front of eye, and pectoral fins well developed. All the species are plainly colored, grayish or dusky above, silvery below, and the dorsal edged with black.

Genera 3, species about 15; in most warm seas, usually at moderate depths. Most of the species undergo a metamorphosis, the young being loosely organized and transparent, band-shaped, and with very small head. The body grows smaller with increased age, owing to compacting of the tissues.

a. Vomerine teeth in bands, none of them canine-like; lips thick.

b. Dorsal fin inserted at a point behind base of pectoral, but nearer pectoral than vent; head with inconspicuous mucus cavities; jaws with an outer series of close-set teeth, forming a cutting edge; tail about half longer than rest of body .... LEPTOCEPHALUS, 10

bb. Dorsal fin beginning over the gill-opening; bones of front of head with large muciferous cavities; mouth rather small; jaws with bands of small teeth, the outer not forming a cutting edge; tail from half to two-thirds of total length .... CONGERMURÆNA

aa. Vomerine teeth uniserial, some of them canine-like; maxillary teeth biserial; dorsal beginning above root of pectoral; cleft of mouth extending beyond middle of eye; tail very long and slender, about half longer than rest of body .... UROCONGER

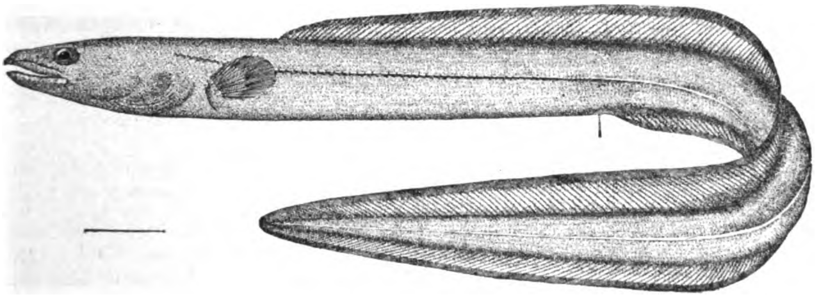

FIG. 6.—*Leptocephalus conger.*

Genus 10. LEPTOCEPHALUS (Gronow) Scopoli.

Body formed as in *Anguilla*, skin scaleless. Head depressed above, anteriorly pointed. Lateral line present. Mouth wide, its cleft extending at least to below middle of eye. Teeth in outer series in each jaw equal and close-set, forming a cutting edge; no canines; band of vomerine teeth short. Tongue anteriorly free. Vertical fins well developed, confluent around tail; pectoral fins well developed; dorsal beginning close behind pectorals. Gill-openings rather large, low. Eyes well developed; posterior nostril near eye, the anterior near tip of snout, with short tube. Lower jaw not projecting. Skeleton differing in numerous respects from that of *Anguilla*. Vertebræ about 56+100.

This genus is found in most warm seas, and contains the well-known and widely distributed conger eel and three or four closely related species. The earliest generic name used for members of the group is *Leptocephalus*, based on a curious, elongate, transparent, band-like creature, with minute head and very small mouth, found in the waters of Europe, and known as *Leptocephalus morrissi*. This has been shown by Gill, Günther, and Facciolá to be the young and larval form of *Leptocephalus conger*. A number of the genera and species of the supposed family of *Leptocephalidæ* have been described, but there is no doubt that all of them are larvæ, some of eels, as *Conger*, *Congermuræna*, *Ophisurus*, and *Nettastoma*, others of Isospondylous fishes, as *Albula*, *Elops*, *Alepocephalus*, *Stomias*, etc. (See Günther, Cat., VIII, 136.) It is thought by Dr. Günther that the Leptocephalid forms are probably "individuals arrested in the development at a very early period of their life, yet continuing to grow to a certain size, without corresponding development of their internal organs, and perishing without having attained the characters of the perfect animal." The recent observations of Dr. Gilbert on the larvæ of *Albula*, *Elops*, and *Conger*, however, seem to point to the conclusion that these curious forms are normal young, and that the individuals grow smaller in size for a time with increased age, owing to the increasing compactness of the tissues.

a. Dorsal beginning nearly opposite tip of pectoral; head about 1.8 in trunk .... *conger*, 12

aa. Dorsal fin beginning above middle of pectoral; head about 1.6 in trunk .... *caudilimbatus*

12. Leptocephalus conger (Linnæus). *Conger Eel; Congrio.*

Dorsal beginning opposite or just behind tip of pectoral; eye 1.5 in snout, 5 to 6 in head; snout 3.25 to 4.25 in head; gape extending nearly or quite to posterior margin of eye; head 1.8 to 1.86 in trunk; tail longer than rest of body; pectoral 3.5 in head; upper lip full, with conspicuous pores.

Ashy-gray or blackish; vertical fins with black margin; body sometimes (var. *niger*) entirely black.

Atlantic Ocean, generally common on both coasts, from Cape Cod to Brazil; also on coasts of Asia and Africa; almost cosmopolitan, but not found in the eastern Pacific. It reaches a length of 8 feet, and is an important food-fish, especially in Europe. Recorded by Dr. Stahl; not obtained by us in Porto Rico.

(*a*) LARVAL FORMS.

Leptocephalus morrissi Gmelin, Syst. Nat., 1150, 1788, Holyhead, England.
Ophidium pellucidum Couch, Lond. Mag. Nat. Hist., V, 1832, 313, 742, England.
Leptocephalus gracilis Storer, Mem. Amer. Acad., II, 524, 1839, Massachusetts.
Leptocephalus spallanzanii, candidissimus, etc., of European writers.

(*b*) ADULT FORMS.

Muræna supremo margine pinnæ dorsalis nigro Artedi, Synon., 40, 2, 1738, Mediterranean.
Muræna conger Linnæus, Syst. Nat., X, 245, 1758, Mediterranean Sea; based on Artedi.
Muræna nigra Risso, Ich. Nice, 93, 1810 (black variety), Nice.
Anguilla oceanica Mitchill, Jour. Ac. Nat. Sci. Phila. 1818, 407, off New York.
Conger verus Risso, Eur. Mér., III, 201,1826, Nice.
Conger vulgaris Cuvier, Règne Animal, ed. II, vol. 2, 350, 1829, France; Günther, Cat., VIII, 38, 1870.
Conger rubescens Ranzani, De Novis Spec. Pisc. Diss. Prima, 19, pl. V, fig. 5, 1838, Mediterranean.
Ophisoma obtusa Swainson, Fish., Rep., and Amph., II, 395, 1839, Sicily.
Conger orbignyanus Valenciennes, D'Orbigny, Voy. Am. Mérid., Poiss., pl. 12, 2. 1839, South America.
Conger esculentus Poey, Memorias, II, 346, 1860, Cuba; Stahl, l. c., 80, 1883 (misprinted "Conges").
Leptocephalus conger, Jordan & Evermann, l. c., 354, 1896.

Family X. MURÆNESOCIDÆ.

Scaleless anguilloid eels, with posterior nostril not labial, tongue largely adnate, jaws not excessively elongate, end of tail surrounded by caudal fin, and pectoral fins well developed. None of these characters appears to have in itself great importance, but, according to Dr. Gill, in the genus *Murænesox*, the only genus in which the osteology is well known, the characters are such as fully to justify family distinction.

Dr. Gill gives the following diagnosis of the *Murænesocidæ:* "Enchelycephalous Apodals with the tongue not free, the branchiostegal membrane connecting the opposite sides below, the epipharyngeals reduced to one pair, and the hypopharyngeals linguiform and encroaching on the fourth branchial arch." To this should be added: Gill-openings rather wide; pectoral fins well developed; jaws of moderate length; vomer well armed.

Whether all these characters are found in the other genera commonly associated with the *Murænesox* is not yet known. The family, as understood by us, seems divisible into two well-marked groups, which are, perhaps, as distinct from each other as from the *Echelidæ* or the *Congridæ*. The species of this family are not very numerous, and a large proportion are American. In general appearance and habits they approach the congers. All are plainly colored, and some descend to rather deep water. One genus represented in Porto Rico.

MURÆNESOCINÆ:
  a. Dorsal and anal fins well developed throughout, the dorsal beginning nearly above gill-opening; snout moderately produced; vomerine teeth very strong.
    b. Teeth in jaws in several series; gill-openings wide .... MURÆNESOX, 11
    bb. Teeth in jaws biserial, small; vomer with a series of long, pointed canines; tail about four times as long as rest of body; gill-openings narrow .... HOPLUNNIS
STILBISCINÆ:
  aa. Dorsal and anal fins very low anteriorly, developed chiefly on the tail.
    c. Tail about as long as rest of body; teeth moderate; dorsal beginning before the vent. Body moderately elongate, diameter more than one-thirtieth the length; dorsal beginning just before vent .... NEOCONGER
    cc. Tail short, little more than half as long as rest of body; teeth all uniserial, unequal, some of them canine-like; body very slender, whip-shaped.
      d. Dorsal fin beginning not far behind pectoral .... LEPTOCONGER
      dd. Dorsal fin beginning behind the vent .... STILBISCUS
      ddd. Dorsal fin beginning close behind the nape .... GORDIICHTHYS

Genus 11. MURÆNESOX McClelland.

Body robust. Dorsal and anal fins well developed, dorsal beginning nearly above gill-opening. Mouth large, teeth in jaws in several series, those of one series enlarged and depressed, forming long canines in front; vomer with several long series of teeth, the middle one of strong canines.

This genus contains numerous species, large, conger-like eels, some of which are found in all warm seas. They are remarkable for the strong armature of the vomer. One species known from Porto Rico.

13. **Murænesox savanna** (Cuvier).

Median series of teeth on vomer distinctly tricuspidate in the young, becoming entire with age, with nearly even surface; pectorals as long as maxillary, 2.66 in head; eye 2 in snout, which is 4.5 in head; dorsal inserted over gill-opening.

Brown above, silvery below; dorsal and anal edged with black.

Cuba to Rio Janeiro, not common; occasional in the Mediterranean Sea. Not obtained by us in Porto Rico, but included on authority of Poey.

Muræna savanna Cuvier, Règne Animal, ed. 2, vol. 2, 350, 1829, Martinique.
Conger brasiliensis Ranzani, Nov. Spec. Pisc. Diss. Prima, IV, 17, pl. 13, fig. 1, 1838, Brazil.
Congrus curvidens Richardson, Voy. Erebus and Terror, 111, 1844, no locality given.
Cynoponticus ferox Costa, Fauna Napoli, Pesc., pl. 28, 1854, Naples.
Conger limbatus Castlenau, Anim. Am. Sud, 83, pl. 43, fig. 3, 1855, Rio Janeiro.
Murænesox savanna, Poey, Fauna Puerto-Riqueña, 344, 1881; Stahl, l. c., 166, 1883; Jordan & Evermann, l. c., 360, 1896.

Family XI. MORINGUIDÆ. The Whip Eels.

Excessively elongate eels, with the abdominal cavity forming two-thirds of the length (the anus opening about the commencement of the last third) and the heart far behind gills. Body scaleless; cylindrical, with the trunk much longer than the tail; pectorals none or small; vertical fins but little developed, limited to the tail; posterior nostril in front of small eye; cleft of mouth narrow; teeth uniserial; gill-opening rather narrow, inferior.

Genus 13. APHTHALMICHTHYS Kaup.

Characters of the genus included above.

14. **Aphthalmichthys caribbeus** Gill & Smith.

Body exceedingly long and slender, the trunk of uniform depth throughout and not compressed, post-anal part of body slightly compressed. Head long, not conspicuously wider than body, its length contained 13 times in total length of fish, nearly 9 times in distance between snout and vent, and 4 times in tail. Anterior nostrils large and tubular, at end of snout; posterior nostrils large, immediately in front of eye. Length of snout one-seventh that of head. Gape equal to depth of body, about one-fourth length of head extending considerably beyond eye. Lower jaw projecting. Teeth rather large, canine, retrorse, uniserial, a single row of small teeth on vomer. Eye very small and rudimentary, little larger than the posterior nostril, and contained over 20 times in length of head and 3 times in snout. Interorbital narrow, about half length of snout. Depth of body contained 54 times in total length, 4.2 times in head. About the length of the head behind vent, a narrow, shallow groove extends backward on both the dorsal and ventral surfaces; in this groove the dorsal and anal fins exist as low ridges, and are entirely undeveloped until about length of head from end of body; they then become less than half a millimeter in height and are confluent around the blunt tail. The pectoral is a mere rudiment lying on the upper posterior edge of the gill-slit and is less than half the length of the latter. The branchial openings are nearly vertical slits, about twice length of eye, and separated from each other by a space equal to 1.5 times their length. The ventral opening is situated a little more than two-thirds the distance from snout to end of tail. A series of large circular pores along lateral line.

Color in life, a uniform grayish-olive, without markings. The type, 270 mm. long, collected among coral (*Porites*) at San Geronimo, Porto Rico, by Mr. George M. Gray.

The following table gives the measurements:

Measurements.	Millimeters.	Measurements.	Millimeters.
Length	270	Length of snout	3
Length of head	21	Interorbital	2.5
Length of head and trunk	185	Dorsal groove behind vent	21
Length of post-ventral region	85	Anal groove behind vent	21
Depth at gill-slit	5	Dorsal fin appears above surface, in front of end of tail	21
Depth at vent	4.5		
Depth at dorsal origin	5	Anal fin appears above surface, in front of end of tail about	16
Length of gape	5		

Aphthalmicthys caribbeus Gill & Smith, Science, n. s., vol. XI, Nos. 286, 973, June 22, 1900, San Geronimo, Porto Rico.

Family XII. MYRIDÆ. The Worm Eels.

End of tail surrounded by the confluent vertical fins; posterior nostril in, or very near, upper lip, the tongue more or less fully adnate to the floor of the mouth. The species are usually of small size and plain colors, more or less worm-like in form, and inhabit sandy coasts in tropical seas. The genera have but few species each. They are intermediate in character between the *Ophichthyidæ* and the *Murænesocidæ*. The osteology has not been carefully studied, but they will probably be found to be most nearly related to the latter family, if indeed the two should not be, as in Bleeker's arrangement, reunited with the *Leptocephalidæ*.

a. Body elongate, subterete; pectoral present, sometimes minute; anterior nostril tubular; dorsal fin beginning behind head; teeth small.

b. Dorsal fin beginning behind vent; no teeth on vomer; teeth mostly uniserial; body slender, terete .... AHLIA

bb. Dorsal fin beginning before vent; vomer with teeth.

c. Dorsal beginning at a point about midway between gill-opening and vent; pectoral very small; teeth subequal; body slender, terete; tail much longer than rest of body .... MYROPHIS

aa. Body short, much compressed; pectoral almost invisible; mouth narrow; snout obtuse, depressed; vertical fins well developed, dorsal beginning behind gill-opening .... CHILORHINUS, 13

Genus 13. CHILORHINUS Lütken.

Body short, much compressed, especially posteriorly; mouth narrow, lower jaw slightly the shorter; snout depressed, obtuse, two rows of short conic or incisor-like teeth on each palatine and a group of similar teeth on nasals, back of which is a large tooth on anterior end of vomer; teeth on lower jaw triserial; pectoral fin very minute; vertical fins well developed, dorsal commencing behind gill-opening. One species known.

15. Chilorhinus suensonii Lütken. *Worm Eel.*

Head 5; depth 14.4; eye 8; snout 6.3; interorbital 5.6; cleft of mouth 3.6 in head; head and trunk a little less than half total length; dorsal fin beginning a short distance back of gill-opening, slightly nearer vent than tip of snout.

Body elongate, trunk slightly compressed anteriorly, much so posteriorly; head large, deeper and wider than body, its width somewhat greater than its depth, its upper surface convex; snout slightly tapering, rather broadly truncate; eye chiefly lateral, posterior border just above the angle of mouth; cleft of mouth horizontal, lower jaw included, lips fleshy, upper slightly overhanging the closed mouth, its outline somewhat irregular; a double series of short canine-like teeth on each palatine, similar teeth on nasals, behind which is a large tooth on vomer; teeth on lower jaw triserial; anterior nostril in a short tube well forward at edge of lip, directed downward; posterior nostril without tube, opening in lower part of upper lip just in front of eye, scarcely visible when mouth is closed; skin not firmly attached to body, more or less movable, especially full and loose about head, where it is gathered into longitudinal folds; dorsal and anal regular in outline, somewhat lower near their confluence; anal very slightly lower than dorsal, each with numerous rays; lateral line present, being a straight shallow groove running nearer dorsal outline anteriorly, containing a series of muciferous pores.

Color in spirits: Nearly everywhere uniform dark-brown; belly and ventral surface of head white.

Twenty-seven individuals, from 1.5 to 4.4 inches in length, were collected at Mayaguez, Ponce, Arroyo, Hucares, and Boqueron. Hitherto known only from St. Croix, Danish West Indies.

Chilorhinus suensonii Lütken, Vid. Med. Naturg. Foren. Kjöben., I, 1851, St. Croix; Jordan & Evermann, l. c. 372, 1896.

Family XIII. OPHICHTHYIDÆ. The Snake Eels.

This family includes those enchelycephalous eels which are scaleless and have the end of the tail projecting beyond dorsal and anal fins, and without rudiment of a caudal fin. Anterior nostrils placed in upper lip, opening downward; gill-openings not confluent; tongue more or less fully adnate to floor of mouth. Species usually moderate or small in size, very abundant in tropical seas, especially about coral reefs. The eggs are numerous, of moderate size, similar to those of ordinary fishes.

Of 12 genera of this family occurring in America only 4 are known to have species in Porto Rico.

a. Body without traces of fins anywhere; teeth all small, conical; gill-openings near together, subinferior; anterior nostril tubular; tongue scarcely free in front; mouth small.
b. Gill-slits inferior, converging forward .... SPHAGEBRANCHUS, 14
bb. Gill-slits small, lateral, placed vertically .... VERMA
aa. Body with distinct fins, at least on back.
c. Anal fin wholly wanting; no pectoral fin; dorsal fin high, beginning on head; gill-openings subinferior, converging; anterior nostrils tubular; tongue slender, somewhat free in front .... LETHARCHUS
cc. Anal fin well developed; anterior nostril usually in a short tube near tip of snout.
d. Teeth blunt, mostly granular or molar; vomer with teeth; pectoral fins present, small.
e. Dorsal rather high, beginning on head, before gill-opening .... MYRICHTHYS, 15
ee. Dorsal fin beginning behind gill-opening, fin usually low .... PISOODONOPHIS
dd. Teeth all pointed, none of them molar; vomer with teeth.
f. Dorsal fin beginning before nape, on anterior part of head; pectoral fin small or wanting.
g. Pectoral fins wholly wanting; body compressed, dorsal fin high .... CALLECHELYS
gg. Pectoral fins small, but present; body elongate, subterete, dorsal fin moderate .... BASCANICHTHYS
ff. Dorsal fin beginning more or less behind gill-opening.
h. Teeth subequal, with no elongate canines on jaws or vomer .... OPHICHTHUS, 16
hh. Teeth unequal, some of them long canines, either on vomer or on sides of one or both jaws; mouth large, snout short, and eyes more or less superior .... MYSTRIOPHIS

Genus 14. SPHAGEBRANCHUS Bloch.

This genus contains several little-known species of small eels remarkable for showing no trace of fins in the adult stage. The snout projects beyond the small mouth, giving a shark-like profile, and the small teeth are mostly uniserial. Gill-slits inferior and converging. The name *Sphagebranchus* was based on a species which evidently belongs to the genus. It has, therefore, clear priority over *Ichthyapus* and *Apterichthys*.

This genus is the most simple in structure among the genera of *Ophichthyidæ*, as *Ophichthus* is probably the most specialized. Its loss of fins is doubtless due to degeneration, but it seems nearer the primitive type than *Brachysomophis* or *Ophichthus*. Only one species obtained in Porto Rico.

a. Head 6 times in trunk .... *anguiformis*
aa. Head little more than 4 times in trunk.
b. Color brown, head mottled .... *sclachops*
bb. Color greenish, without mottlings .... *ophioneus*, 16

16. Sphagebranchus ophioneus Evermann & Marsh, new species.

Head 4.5 in distance from tip of snout to vent, 12.5 in total length; depth of trunk 48 times in total length, depth of head 36 times; distance from tip of snout to vent 2.8 in total length; snout 6 in head, mandible 2.5, interorbital 12.7.

Body cylindrical, tail tapering; longest diameter of head greater than that of body; head forward of occipital region long, slender, conic, and sharply pointed; eye minute; mouth inferior, the pointed snout far overhanging, tip of lower jaw considerably in front of eye; teeth numerous, directed backward, conic, sharp, depressible, uniserial in each jaw and on vomer; roof of mouth not entirely covered by lower jaw, exposing a triangular space in front of its tip, a single tooth exposed in front on median line when the mouth is closed; in the preserved specimen the tooth next behind on each side is also exposed, probably due to the contraction of the fleshy tip of lower jaw; a few fleshy papillæ at edge of upper lip on each side opposite tip of lower jaw; nostrils not tubular, the anterior on ventral side of fleshy tip of snout, the entrance guarded by a pair of fleshy papillæ; the posterior in upper lip just behind tip of lower jaw which covers nostril when mouth is closed; a row of muciferous pores on each ramus of mandible; scattered pores about snout, behind eyes and along upper lip, and a transverse row across head at occiput; lateral line distinct, complete, and continuous, commencing on side of head and extending to tip of tail, consisting of a slight elevation of the integument, the pores arranged at regular intervals along its lower edge; gill-slits 5.4 in head, entirely inferior, converging anteriorly where they are very narrowly separated; skin over branchial chambers with longitudinal plications.

Color in spirits: Everywhere pale-green, without evident markings; traces of a faint yellowish area on side of head, in front of occiput, and on snout; tip of snout a little darker.

One specimen, the type (No. 49526 U.S.N.M.) 11.25 inches long, dredged in 4 fathoms at Fish Hawk Station 6065, off Mayaguez, Porto Rico, January 20.

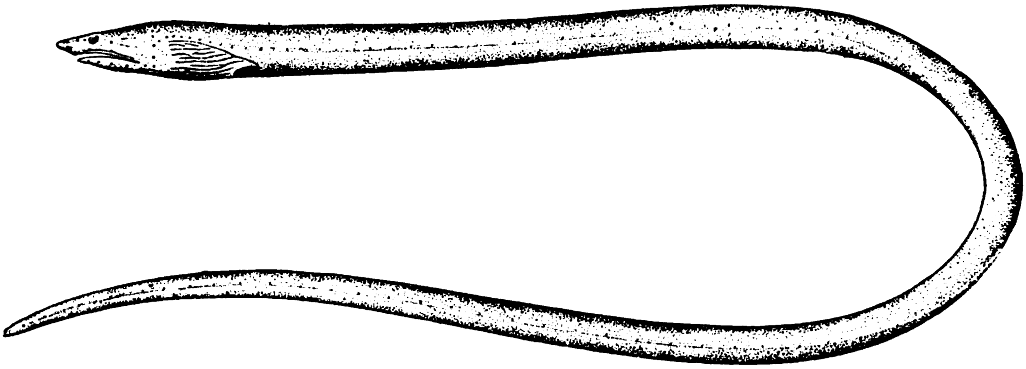

FIG. 7.—*Sphagebranchus ophioneus.*

Genus 15. **MYRICHTHYS** Girard.

Teeth mostly blunt and molar; pectoral fins small; dorsal beginning on head before gill-opening; otherwise essentially as in *Ophichthus*. Coloration variegated. Species numerous, found in most tropical seas. Only one of the three American species known from Porto Rico.

a. Spots on body large, black, most of them with a distinct pale center, the ground-color paler .... *oculatus*, 17

aa. Spots on body large, round, nearly whitish in color, the ground-color dark .... *acuminatus*

17. **Myrichthys oculatus** (Kaup).

Head 4.2 in trunk (tip of snout to vent); eye 2.5 in snout; interorbital 6 in head, slightly shorter than snout; cleft of mouth 3.25 in head.

Body scaleless, very slender, tail tapering to a point, without caudal fin; dorsal and anal fins not continuous around it; dorsal low, commencing on head far in advance of gill-opening, extending almost to tip of tail; anal similar, shorter and lower; pectoral reduced to a thin, narrow, membranaceous flap immediately behind gill-opening; anterior profile of head straight, making an angle of 45° with the horizontal mouth; eye very small; nostril tubular, on side of tip of snout; lower jaw considerably the shorter, upper overhanging, exposing some of the teeth, which are all small, molar, and scarcely elevated.

Color in spirits: Body grayish, trunk paler below; side with two rows of about 35 large roundish black spots not sharply circumscribed, the center of each with a small pale spot, upper row close to dorsal fin, other row just below, the spots above alternating with those below; a large dark spot on the head in front of the dorsal; lower jaw and snout with numerous much smaller dark spots, some of these with a pale center; dorsal with dark-brown edge and many diffuse blotches of same; anal pale, unmarked.

Tropical Atlantic, Cuba to Surinam, and Cape Verde Islands. One specimen, nearly 2 feet lg,on collected at Hucares, Porto Rico.

Pisoodonophis oculatus Kaup, Apodes, 22, 1856, Curaçao.
Ophisurus latimaculatus Poey, Repertorio, II, 252, pl. 3, fig. 1, 1867, Cuba.
Ophichthys latimaculatus, Poey, Fauna Puerto-Riqueña, 345, 1881.
Myrichthys oculatus, Jordan & Evermann, l. c., 376, 1896.

Genus 16. OPHICHTHUS Thunberg & Ahl.

This genus contains all the ophisuroid eels which have sharp teeth, no marked canines, well-developed pectoral fins, and dorsal inserted behind head. The species are very numerous in the tropical seas, and many attempts have been made to split the group into smaller genera. Notwithstanding the great differences when extremes are compared, these small genera can not be well defined. Only one of the ten American species is known from Porto Rico.

a. Teeth of upper jaw in two or three series.
  b. Teeth of lower jaw uniserial, or nearly so; vomerine teeth in one series or slightly biserial in front.
CRYPTOPTERUS:
  c. Coloration uniform, or nearly so; teeth of lower jaw not quite uniserial; tail half longer than rest of body .... *puncticeps*
OPHICHTHUS:
  cc. Coloration not uniform; anterior teeth slightly enlarged; eye rather large, nearly median.
    d. Sides of body with large, round, black spots; head with smaller ones; dorsal inserted opposite tip of pectoral .... *havannensis*
    dd. Sides of body with large, round, whitish spots; dorsal inserted behind tip of pectoral .... *retropinnis*
  bb. Teeth of lower jaw in two to four series.
MURÆNOPSIS:
  e. Vomerine teeth in one row; anterior teeth of jaws or vomer sometimes enlarged; teeth in both jaws biserial, those of inner series sometimes small and turned inward.
    f. Dorsal beginning an eye's diameter behind tip of pectoral .... *guttifer*
    ff. Dorsal beginning over or just before tip of pectoral .... *ocellatus*
SCYTALOPHIS:
  ee. Vomerine teeth biserial throughout; teeth in both jaws biserial, subequal; no canines. Color plain-brownish.
    g. Eye large, more than half length of snout.
      h. Head rather short, 2.5 to 3 in trunk .... *gomesii*, 18
      hh. Head long, 1.75 to 2.25 in trunk; pectoral a little longer than gape .... *magnioculis*
    gg. Eye small, 2.5 in snout; gill-opening narrow; anterior nostril with long tube; pectoral longer than gape... *parilis*

18. **Ophicthus gomesii** (Castelnau). *Sea Serpent.*

Head 2.8 in trunk; head and trunk 2 in tail; eye about equal to interorbital space, 1.5 in snout, which is 6 in head; pectoral 2.8 in head; teeth small, sharp and subequal, biserial on each jaw and on vomer; upper jaw the longer; pores on head and lower jaw; dorsal and anal very low.

Color in spirits: Everywhere brownish above, color laid on in a multitude of very small brown points somewhat in rows, on a yellow ground; ventral surface yellow with a few brown points; side of head and lower jaw with dusky spots; dorsal edge of pectoral with dusky points.

South Carolina to Rio Janeiro; generally common, especially about the Florida Keys and Cuba. One example 8.5 inches long collected at Mayaguez.

Ophisurus gomesii Castelnau, Anim. Amér. Sud, 84, pl. 44, fig. 2, 1855, Rio Janeiro.
Ophisurus chrysops Poey, Memorias, II, 321, 1867, Havana.
Orydontichthys brachyurus Poey, Synopsis, 426, 1868, Havana.
Oxydontichthys macrurus Poey, Anal. Soc. Hist. Nat. Esp., 1880, 254, Havana.
Ophicthus gomesii, Jordan & Evermann, l. c., 384, 1896.

Family XIV. MURÆNIDÆ. The Morays.

The *Murænidæ* represent the most degenerate type of eels so far as the skeleton is concerned, and are doubtless the farthest removed from the more typical fishes from which the eels have descended. The essential characters of the family are thus stated by Dr. Gill: "Colocephalous apodals with conic head, fully developed opercular apparatus, long and wide ethmoid, posterior maxillines, pauciserial teeth, roundish, lateral branchial apertures, diversiform vertical fins, pectoral fins (typically) suppressed, scaleless skin, restricted interbranchial slits, and very imperfect branchial skeleton, with the fourth branchial arch modified, strengthened, and supporting pharyngeal jaws."

The morays may be readily distinguished from other eels by their small round gill-openings and by absence of pectorals. The body and fins are covered by a thick leathery skin, the occipital region is elevated through the development of the strong muscles which move the lower jaw, and the jaws are usually narrow and armed with knife-like or else molar teeth. They inhabit tropical and subtropical waters, being especially abundant in crevices about coral reefs. Many of the species reach a large size, and all are voracious and pugnacious. Coloration usually strongly marked, the color cells being highly specialized. Only two of the eight American genera represented in Porto Rico.

a. Vertical fins well developed, dorsal beginning before vent.
b. Posterior nostril an oblong slit; anterior in a short tube; teeth all pointed; dorsal beginning above gill-opening; canine teeth strong; tail moderate.. ENCHELYCORE
bb. Posterior nostril circular, with or without tube; tail moderate, not twice as long as trunk; body not excessively elongate.
c. Teeth all, or nearly all, acute, none of those in jaws obtuse or molar-like.
d. Anterior nostrils without tube; vomerine teeth in many series; lips with a free fold.............. PYTHONICHTHYS
dd. Anterior nostrils each with a long tube; vomerine teeth in one or two series; lips continuous with skin of head.
e. Posterior nostrils without tube, margins sometimes slightly raised.
f. Dorsal fin inserted behind head, over or behind the gill-opening.................................... RABULA
ff. Dorsal fin inserted on head, considerably before gill-opening.. LYCODONTIS, 17
ee. Posterior nostrils as well as anterior each in a conspicuous tube.................................... MURÆNA
cc. Teeth mostly obtuse, molar-like; only anterior nostrils tubular; cleft of mouth rather short; dorsal beginning before gill-opening.. ECHIDNA, 18
aa. Vertical fins rudimentary, confined to end of tail (often appreciable only on dissection, or altogether wanting); teeth rather small, pointed, subequal, in several series; posterior nostril round, with a short tube, or none, CHANNOMURÆNA

Genus 17. LYCODONTIS McClelland.

This genus, as here understood, comprises the great bulk of the *Murænidæ*, including all the species with sharp teeth, the body normally formed, anterior nostrils only tubular, and the dorsal fin beginning on head. *Priodonophis* with serrated teeth has been recognized as a distinct genus by Bleeker, but the character in question disappears by degrees and seems not to be suitable for generic distinction. The morays of this genus are everywhere abundant in tropical seas, where some reach a great size. They are the most active and voracious of the eels, often showing much pugnacity. Most of them live in shallow water about rocks or reefs. Four species known from Porto Rico.

a. Teeth all entire, with no serrations anywhere, and none of them with basal lobes.
b. Body without small, round, bluish-white or yellow spots, the spots, if any, blackish or dull-grayish; dorsal without distinct paler margin, or with merely the very edge whitish.
c. Dorsal with a distinct black margin; anal with a pale edge; teeth uniserial.................................. *vicinus*
cc. Dorsal without distinct, darker margin, its border colored nearly or quite like rest of fin.
d. Body and tail covered with close-set dark points; tail longer than rest of body............................ *virescens*
dd. Body and tail not covered with close-set dark points.
e. Color olivaceous or brownish, with conspicuous markings, marblings or spots darker than the ground-color; belly without distinct transverse lines, marked like the back and sides; tail slightly longer than rest of body.
f. Dark markings forming narrow reticulations, never rounded spots; these reticulations dark-lilac in color, covering back and sides, some of them inclosing irregular polygons.. *polygonius*
ff. Dark markings in the form of rounded spots, more or less confluent, sometimes obscuring the pale ground-color.. *moringa*, 19
ee. Color dark-brown, dark-green, or blackish, either plain or with faint markings.
g. Belly with black, wavy, transverse lines; no dark lines along dorsal fin.................................. *mordax*
gg. Belly without black transverse lines; body nearly plain dark olive-brown.
h. Dorsal and anal with dark longitudinal streaks; chin pale but not white................................ *funebris*, 20
hh. Dorsal and anal without dark longitudinal streaks; chin white.. *albimentis*, 21
eee. Color brownish-black with irregular pale-grayish spots of various sizes; margin of anal not pale; cleft of mouth less than half head.. *sanctæ-helenæ*
bb. Body with distinct small spots, blue, white, or yellow.
i. Dorsal and anal without distinct colored margin; pale spots mostly smaller than eye.
j. Teeth of upper jaw uniserial.
k. Vomerine teeth uniserial; spots irregular, few, and scattered; dorsal colored like back.
kk. Vomerine teeth biserial; entire body covered with small blue dots; dorsal with vertical bluish streaks.. *conspersus*
jj. Teeth of upper jaw biserial; body with small yellow spots.
l. Vomerine teeth uniserial, mostly small and rounded; color nearly uniform from head to tail; spots innumerable.. *miliaris*
ll. Vomerine teeth biserial, small and rounded; color dark-brown, with yellow points excessively numerous. *elaboratus*
ii. Dorsal with a blackish border, interrupted with white; anal with white markings; body with close-set, irregular pale spots.
m. Body greenish, marbled with brownish, almost obscured by the ground-color.......................... *obscuratus*
mm. Body rich-yellow or tawny; head and body covered with small, round, white spots...................... *jordani*, 22
PRIODONOPHIS:
aa. Teeth serrate, more or less.
n. Color brown, with irregular light-yellowish spots irregularly placed; dorsal with large, dark spots on its edge, these sometimes obsolete, usually running together to form a continuous dark band; anal black-edged; teeth large, uniserial, the larger ones serrate; mouth nearly closing.. *ocellatus*

19. **Lycodontis moringa** (Cuvier). *Common Spotted Moray; Hamlet.*

Head 3.2; snout 6 in head; eye 1.5 in snout; cleft of mouth 2.5 in head; tail somewhat longer than trunk. Teeth strong and sharp; two or three long depressible teeth on vomer in front and a median row of small ones behind; teeth in jaws uniserial, long in front, those behind retrorse.

Color in spirits: Dark-brown, everywhere mottled and reticulated with paler or light yellow, which is properly the ground-color, but is nearly covered by the dark pigment; ventral surface of head pale with a few brown spots; fins colored like body.

West Indies, Pensacola to Rio Janeiro and St. Helena. Two young examples, about 7 inches long, from Culebra.

Muræna maculata nigra (the Black Moray), Catesby, Nat. Hist. Carolina, etc., pl. 21, 1738, Bahamas.
Muræna moringa Cuvier, Règne Animal, ed. II, vol. II, 352, 1829, Bahamas; after Catesby.
Gymnothorax rostratus Agassiz, Spix, Pisc. Bras., 91, pl. 50, *a*, 1829, Brazil; Stahl, l. c., 80, 1883.
Muræna moringua Richardson, Voy. Erebus and Terror, Fishes, 89, 1844, Jamaica.
Muræna punctata Gronow, Catalogue Fishes, 18, 1854, North America.
Murenophis curvilineata Castelnau, Anim. Amér. Sud, Poiss., 81, pl. 42, fig. 2, 1855, Rio Janeiro.
Murænophis caramura Castelnau, Anim. Nouv. Rares Amérique du Sud, 85, pl. 43, fig. 1, 1855, Bahia.
Gymnothorax flavoscriptus Poey, Enumeratio, 158, 1875, Cuba.
Gymnothorax picturatus Poey, Anal. Soc. Esp. Hist. Nat. 1880, 257, Cuba.
Lycodontis moringa, Jordan & Evermann, l. c., 395, 1896.

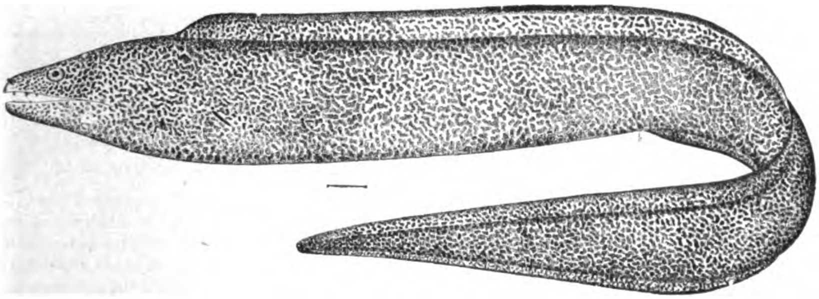

FIG. 8.—*Lycodontis moringa.*

20. **Lycodontis funebris** (Ranzani). *Black Moray; Morena Verde.*

Tail a little longer than head and trunk. Teeth uniserial in jaws in the adult; teeth on vomer uniserial (var.? *erebus*), or biserial (*funebris*); long, depressible canines on front of vomer; jaws not completely closing; eye 2 to 2.5 in snout, above middle of gape; cleft of mouth 2.5 in head; head 2.5 in trunk.

Dark olive-brown, nearly plain, paler on throat, sometimes with very faint darker marblings; dorsal and anal fins with dark lines running longitudinally; belly without black transverse lines.

Found in tropical America, on both coasts; the largest of our eels, reaching 5 or 6 feet or more; extremely ferocious; common from Florida Keys to Rio Janeiro and from Gulf of California to Panama. A single example, 4.12 inches long, obtained at Fajardo February 17, 1899.

Muræna maculata nigra et viridis, Catesby, Nat. Hist. Carolina, etc., pl. 20, 1738, Bahamas.
Gymnothorax funebris Ranzani, Nov. Comm. Ac. Sc. Bonon., IV, 76, 1840, Brazil.
Muræna lineopinnis Richardson, Voy. Erebus and Terror, Fishes, 89, 1844, Puerto Cabello.
Tæniophis westphali Kaup, Aale Hamburg Mus., I, 1859.
Thrysoidea aterrima Kaup, Aale Hamburg Mus., I, 22, 1859.
Muræna infernalis Poey, Memorias, II, 347 and 354, 1860, Cuba.
Thrysoidea concolor Abbott, Proc. Ac. Nat. Sci. Phila. 1860, 479, Vera Cruz.
Muræna erebus Poey, Memorias, II, 426, 1861, Cuba.
Lycodontis funebris, Jordan & Evermann, l. c., 396, 1896.

21. **Lycodontis albimentis** Evermann & Marsh, new species.

Head 6.4; snout about 7; mandible 1.8; eye 2.3 in cleft of mouth; head and trunk somewhat compressed, tail considerably so; cleft of mouth a little less than half of head; jaws equal; teeth strong, conical, and sharp, in one rather irregular row in upper jaw, strongest in front; in lower jaw one row of similar teeth, becoming smaller posteriorly, those in front stronger than in upper jaw; eye rather large, slightly nearer tip of snout than angle of mouth, bordering the lip; upper lip with a row of very minute cirri along the edge, resembling teeth, visible only under a lens; a row of rather large pores around upper lip and a pair on top of snout; anterior nostril tubular, in the lip at angle of snout; posterior nostril without tube, just above front of eye; fins higher posteriorly.

Color in spirits: Everywhere uniform dark-brown, except lower part of head and edge of fins; upper lip and lower jaw perfectly white, the brown sharply demarcated from the colorless area, which begins just back of mandible, extending over lower jaw, past angle of mouth, along upper lip, under eye, and around snout; inside of mouth colorless; fins darker than body, narrowly pale-edged posteriorly.

One very small specimen, only 2 inches long, brought up by the tangle from coral bottom in 15 fathoms at Fish Hawk station 6093, off Culebra Island, February 8; possibly the young of a known species, but the sharply defined white area on the lower jaw is so prominent a character that we have thought it best to describe the species as new. Type No. 49527 U.S.N.M.

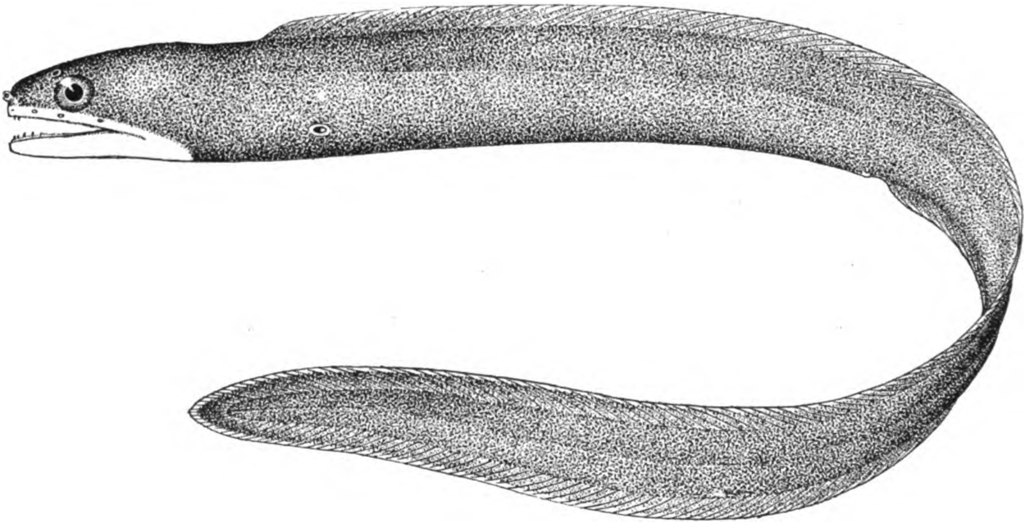

FIG. 9.—*Lycodontis albimentis.*

22. **Lycodontis jordani** Evermann & Marsh.

(PLATE 2.)

Head 7 in total length; depth about 14; eye 8 in head; snout 5; gape 2.2; interorbital a little less than snout. Teeth uniserial, strong, sharp, not close-set, all entire and without basal lobes; tail considerably longer than rest of body; gill-opening smaller than eye; snout rather pointed, lower jaw the shorter, the mouth capable of being completely closed. Dorsal fin high, much higher than anal; nasal tube long, about 3 in eye.

Color in life: Tawny-ochraceous, paler below; upper jaw gray; iris blue; longitudinal brown stripes on side of head in front of gill-opening; head and body covered with numerous small, round, white spots, those on head smallest; a series of larger ones along upper part of side, and one or two irregular series of large ones on side of belly; between these, on middle of side, the spots are smaller; dorsal with an irregular series of small white spots along the base, and another series of about 16 much larger, more quadrate spots of same color along edge of fin, some of the spots cutting the border, which is black; anal similarly spotted and with black border.

In alcohol the general color is grayish-black, yellowish below, the tawny-ochraceous or yellow becoming darker, almost black, and the white spots on body becoming yellowish.

This species seems to be related to *L. obscuratus* (Poey), but differs markedly from it in color. Only the type (No. 49358, U. S. N. M.), a specimen about 15 inches long, was obtained. This was collected at Mayaguez, January 20, 1899.

Lycodontis jordani Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 352, Mayaguez, Porto Rico.

Genus 18. ECHIDNA Forster.

This well-marked genus is distinguished from the other Morays by the blunt teeth. It contains 12 or 15 species, most of them belonging to the Western Pacific and representing the highest degree of specialization among the morays, as *Uropterygius* represents the extreme of degradation. The name *Echidna* was suggested for this group of eels long before its application by Cuvier to a genus of Australian monotremes. Only one species known from Porto Rico.

23. Echidna catenata (Bloch). *Morena*.

Head 3.7 in trunk; eye 2 in snout, which is 6 in head; cleft of mouth 3 in head; trunk a little longer than tail; teeth somewhat molar-like, not very blunt, chiefly uniserial, but reduced in size and biserial in rear of upper jaw; a median series on vomer.

Color in spirits: Ground-color pale-yellow, with some 30 heavy dark-brown transverse bars, some oblique, some branched, some connected, forming heavy reticulations; on ventral portion of trunk these bars are broken into definite roundish spots, these elongate in front of anal, forming a single median series; intermediate pale area of ground-color everywhere marked with dark-brown in spots of all sizes from punctulations to the size of pupil or larger; markings of body extend upon fins.

West Indies, Bermuda to Surinam, generally common. A very handsome eel. Mr. Gray obtained 3 fine specimens at San Geronimo; our collection contains one, of 6.5 inches, from Arroyo.

Muræna seu conger brasiliensis Seba, Thesaurus, II, 72, pl. 69, figs. 4 and 5, 1738, Brazil.
Gymnothorax catenatus Bloch, Ausl. Fische, XII, 74, pl. 415, fig. 1, 1795, Coromandel, an error; Stahl, l. c., 166, 1883.
Murænophis catenula Lacépède, Hist. Nat. Poiss., V, 628 and 641, 1803, Palmerston Island: after Bloch.
Echidna flavofasciata Poey, Repertorio, II, 264, 1868, Cuba.
Echidna fuscomaculata Poey, Repertorio, II, 263, 1868, Cuba.
Echidna catenata, Poey, Fauna Puerto-Riqueña, 345, 1881; Jordan & Evermann, l. c., 403, 1896.

Family XV. ELOPIDÆ. The Tarpons.

Body elongate, more or less compressed, covered with silvery, cycloid scales; head naked. Mouth broad, terminal, the lower jaw prominent. Premaxillaries not protractile, short, the maxillaries forming lateral margins of upper jaw; maxillary composed of about three pieces, extending backward beyond eye; an elongate bony plate between the branches of lower jaw (analogous to gular plate in *Amia*); bands of villiform teeth in both jaws and on vomer, palatines, pterygoids, tongue, and base of skull; no large teeth. Eye large, with an adipose eyelid. Opercular bones thin, with expanded membranaceous borders; a scaly occipital collar. Gill-membranes entirely separate, free from isthmus. Branchiostegals numerous (29 to 35). Gillrakers long and slender. Pseudobranchiæ present or absent. Belly not keeled nor serrated, rather broad and covered with ordinary scales. Lateral line present. Dorsal fin inserted over or slightly behind ventrals; caudal fin forked; no adipose fin; dorsal and anal depressible into a sheath of scales; pectorals and ventrals each with a long accessory scale. Parietal bones meeting along top of head. Pyloric cæca numerous.

Genera three, species about five, forming two well-marked subfamilies, both widely distributed in the tropical seas. Not much valued as food, the flesh being dry and bony.

MEGALOPINÆ:
  a. Pseudobranchiæ none; body oblong, covered with large scales; anal fin larger than dorsal; last ray of dorsal produced in a long filament.
  b. Dorsal fin inserted notably behind insertion of ventrals.......... TARPON, 19
ELOPINÆ:
  aa. Pseudobranchiæ large; body elongate, covered with small scales; anal fin smaller than dorsal; last ray of dorsal not produced in a filament.......... ELOPS, 20

Genus 19. TARPON Jordan & Evermann. Grande Écaille.

Body oblong, compressed, covered with very large, thick, silvery, cycloid scales; belly narrow, but not carinated, its edge with ordinary scales. Mouth large, oblique, the lower jaw prominent; maxillary broad, extending beyond eye. Villiform teeth on jaws, vomer, palatines, tongue, sphenoid, and pterygoid bones. Eye very large, with an adipose eyelid. Lateral line nearly straight, its tubes radiating widely over surface of scales. Branchiostegals 23. Pseudobranchiæ wanting. Gillrakers long and slender. Dorsal fin short and high, inserted behind ventrals (over ventrals in *Megalops*), its last ray elongate and filamentous as in *Megalops*, *Dorosoma*, and *Opisthonema;* anal fin much longer than dorsal, falcate, its last ray produced; caudal widely forked; pectorals and ventrals rather long; anal with a sheath of scales; dorsal naked; caudal more or less scaly; a collar of large scales at the nape. · Vertebræ about 57 (28 + 29). Size very large, the largest of the herring-like fishes.

The posterior insertion of the dorsal fin distinguishes the single species of *Tarpon* from the East Indian *Megalops cyprinoides*. a fish of similar habit, in which the dorsal is inserted above the ventrals.

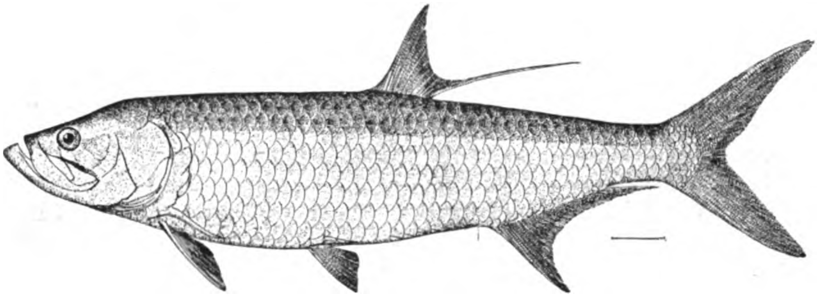

FIG. 10.—*Tarpon atlanticus.*

24. Tarpon atlanticus (Cuvier & Valenciennes).

Tarpon; Tarpum; Grande Écaille; Silver King; "Sabalo"; Savanilla; Savalle.

Head 4; depth 3.75; eye 4.45; snout 5; maxillary 1.65; mandible 1.70; interorbital 4.8; preorbital 11; D. 12; A. 19 or 20; pectoral 1.3; ventral 1.75; scales 5–42–5. Proportions in young of about 3 inches: Head 3.34; depth 4.7; eye 3.3; snout 4.75; maxillary 1.65; mandible 1.6; interorbital 4.6.

Body elongate, compressed, not elevated, with large cycloid scales; mouth large, maxillary reaching far beyond eye, lower jaw projecting; villiform teeth on jaws, vomer, palatines, tongue, sphenoid and pterygoid bones; lateral line straight with radiating tubes; pseudobranchiæ minute; last dorsal ray produced, the fin inserted behind ventrals; pectorals and ventrals each with an accessory scale. Dark above, silvery on sides.

Found from Long Island to Brazil; common on our southern coasts, especially about Florida; common about Porto Rico where it evidently breeds, as numerous immature individuals were taken at Hucares and Fajardo. The four examples from Hucares are from 7.5 to 11.5 inches long and were seined in a small brackish pool of dark-colored water, not over 5 feet deep, in the corner of a mangrove swamp, and at that time (February) entirely separated from the ocean by a narrow strip of land scarcely 25 feet wide. The 13 others are nearly all very young, of 2.25 to 3.25 inches, collected at Fajardo. No large individuals were seen. The young of the tarpon seems to be rare or wanting in collections. The U. S. National Museum contains one individual of about 9 inches. We do not know that any as small as those above mentioned have ever before been recorded.

The tarpon reaches a length of 5 or 6 feet and a weight of 30 to more than 300 pounds. The largest one recorded as taken on a hook weighed 209 pounds, and the largest taken with the harpoon weighed 383 pounds, if we may believe the record; but examples weighing over 100 pounds are not often seen. The silver king is the greatest of game-fishes. "An immense and active fish, preying eagerly on schools of small fry, in pursuit of which it ascends fresh-water streams quite a long distance." It is often dangerous to seine fishermen, leaping over or through their nets with great force.

Megalops atlanticus Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 398, 1846, Guadeloupe, Santo Domingo, Martinique, and Porto Rico; Poey, Fauna Puerto-Riqueña, 343, 1881; Stahl, l. c., 80 and 165, 1883.

Megalops elongatus Girard, Proc. Ac. Nat. Sci. Phila. 1858, 224, Long Island.

Tarpon atlanticus, Jordan & Evermann, l. c., 409, 1896.

Genus 20. ELOPS Linnæus.

Body elongate, covered with thin, small, silvery scales. Dorsal fin slightly behind ventrals, its last rays short, the fin depressible into a sheath of scales; anal fin smaller, similarly depressible; pectorals and ventrals moderate, each with a long accessory scale. Opercular bones thin, with expanded, membranaceous borders; a scaly occipital collar. Lateral line straight, its tubes simple. Pseudobranchiæ present, large. Vertebræ 43 + 29 = 72.

Large fishes of the open seas, remarkable for the development of scaly sheaths. The young are ribbon-shaped and elongate, passing through a series of changes like those seen in *Albula*.

25. Elops saurus Linnæus.

"Piojo"; Matajuelo Real; Chiro; Lisa Francesa; Ten-Pounder; John Mariggle; Bony-fish; Big-eyed Herring.

Head 4.3; depth 5 to 6; eye 5; snout 4.3; maxillary 1.6; mandible 1.5; interorbital 5.6; D. 20; A. 13; pectoral 1.8; ventral 2; caudal 0.8; scales 13–110–12.

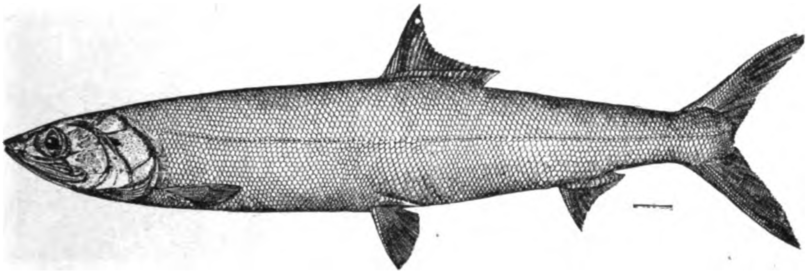

FIG. 11.—*Elops saurus.*

Body very elongate, moderately compressed, scales small and thin, none on head; head small, pointed; mouth very large, the extremely long maxillary reaching far beyond eye, which has a well-developed adipose eyelid, sheathing the eye anteriorly and posteriorly; rather blunt, villiform teeth on jaws, vomer, and palatines and along lower edge of maxillary; jaws subequal; a pointed gular plate; dorsal and anal fins with well-developed basal sheaths of scales, that of dorsal large; ventral with a very large and pointed accessory scale; caudal lobes long and slender. Blue above, the sides silvery.

This species is abundant and widely distributed in the tropical seas. It is common in America north to the Carolinas and the Gulf of California. Probably not uncommon about Porto Rico, though seen by us only at Arecibo, where a specimen 15 inches long was obtained.

Elops saurus Linnæus, Syst. Nat., ed. XII, 518, 1766, Carolina; Jordan & Evermann, l. c., 410, 1896.
Argentina carolina Linnæus, Syst. Nat., ed. XII, 519, 1766, Carolina.
Argentina machnata Forskål, Descr. Anim., 68, 1775, Djidda, Arabia.
Mugilomorus anna-carolina Lacépède, Hist. Nat. Poiss., V, 398, 1803, South Carolina.
Elops inermis Mitchill, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 445, New York.
Elops capensis Smith, Zool. South Africa, 1845, pl. 7, Cape of Good Hope.
Elops purpurascens Richardson, Ichth. China, 311, 1846, China.

Family XVI. ALBULIDÆ. The Lady-fishes.

Body rather elongate, little compressed, covered with rather small, brilliantly silvery scales; head naked. Snout conic, subquadrangular, shaped like the snout of a pig, and overlapping the small, inferior, horizontal mouth. Maxillary rather strong, short, with a distinct supplemental bone, slipping under the membranaceous edge of the very broad preorbital; premaxillaries short, not protractile. Lateral margin of upper jaw formed by maxillaries; both jaws, vomer, and palatines with bands of villiform teeth; broad patches of coarse, blunt, paved teeth on the tongue behind and on the sphenoid and pterygoid bones. Eye large, median in head, with a bony ridge above it, and almost covered with an annular adipose eyelid. Opercle moderate, firm; preopercle with a broad, flat, membranaceous edge, which extends backward over the base of opercle. Pseudobranchiæ present. Gillrakers short, tubercle-like. Gill-membranes entirely separate, free from isthmus; branchiostegals about 14; a fold of skin across gill-membranes anteriorly, its posterior free edge crenate; no gular plate. Lateral line present. Belly not carinate, flattish, covered with ordinary scales. Dorsal fin moderate, in front of ventrals, its membranes scaly; no adipose fin; anal very small; caudal widely forked. Pyloric cæca numerous. Parietal bones meeting along top of head. Vertebræ numerous, 42 + 28 = 70.

A single species known, found in all warm seas. In this, and probably in related families, the young pass through a metamorphosis analogous to that seen in the conger eels. They are for a time elongate, band-shaped, with very small head and loose transparent tissues. From this condition they become gradually shorter and more compact, shrinking from 3 or 3½ inches in length to 2 inches. According to Dr. Gilbert, this process, like that seen in various eels, is a normal one, through which all individuals pass. In the Gulf of California, where these fishes abound, these band-shaped young are often thrown by the waves on the beach in great masses.

Genus 21. ALBULA (Gronow) Bloch & Schneider.

The characters of this genus are included above with those of the family.

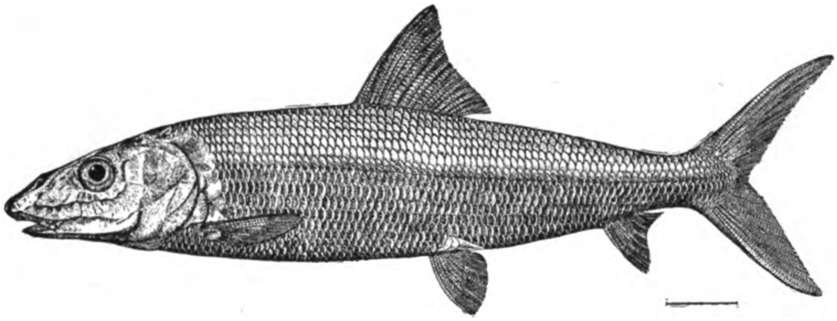

FIG. 12.—*Albula vulpes.*

26. Albula vulpes (Linnæus). "*Macabi*"; "*Piojo*"; *Lady-fish; Bone-fish; Banana-fish.*

Head 3.4; depth 4.5; eye 7; snout 2.2; maxillary 3; interorbital 3.8; preorbital 5.6; D. 15; A. 8; pectoral 1.9; ventral 2.4; caudal 1.1; scales 9–70–6.

Body elongate, robust, the trunk covered with large shining scales with membranous edges; head large, naked, subconic; the snout pig-like, overhanging the inferior mouth, which is armed with villiform teeth; eye high in position, midway between tip of snout and edge of opercle, entirely covered, save for a circular central opening smaller than pupil, with an adipose eyelid; vertical fins scaled, the dorsal and anal very densely; caudal widely forked, upper lobe the longer; median line of back with one series of modified scales, which are smaller and narrower than those of body and have a long membranous appendage much narrower than the scale, this appendage alone exposed.

Color, bright-silvery, darker above; faint longitudinal dark or bluish streaks. A metamorphosis (as in *Elops*) takes place in the young, previous to which they do not resemble the adult.

Tropical seas, on sandy coasts, almost universally distributed and generally abundant, ranging northward on our coasts to San Diego and Massachusetts. Three examples in the collection, one 19 inches long, the others about 12 inches, from San Juan market and Culebra Island. Used as food to some extent, but not highly esteemed.

Umbarana, Marcgrave, Hist. Bras., 1648, Brazil.
Vulpes bahamensis (the Bone-fish), Catesby, Nat. Hist. Carolinas, pl. II, fig. 1, 1737, Bahamas.
Esox vulpes Linnæus, Syst. Nat., ed. X, 1758, 313, Bahamas; after Catesby.
Argentina glossodonta Forskål, Descr. Anim., 68, 1775, Djidda, Arabia.
Macabi, Parra, Dif. Piezas, Cuba, 88, pl. 35, fig. 1, 1787, Cuba; on *Umbarana* of Marcgrave.
Synodus argenteus Bloch & Schneider, Syst. Ichth., 398, 1801, Asia.
Clupea brasiliensis Bloch & Schneider, Syst. Ichth., 427, 1801, Brazil.
Albula conorhynchus Bloch & Schneider, Syst. Ichth., 432, 1801, Antilles; after Gronow and Plumier; Poey, Fauna Puerto-Riqueña, 342, 1881; Stahl, l. c., 80 and 165, 1883.
Amia immaculata Bloch & Schneider, Syst. Ichth., 451, 1801, Central America; after Parra.
Butyrinus banana Lacépède, Hist. Nat. Poiss., V, 46, 1803, Isle de France.

Clupea macrocephala Lacépède, Hist. Nat. Poiss., V, 426, 1803, Martinique; on a drawing by Plumier.

Glossodus forskåli Agassiz, Spix, Pisc. Bras., 49, 1829, Bahia; called *Engraulis sericus* and *Engraulis bahiensis* on the plates, 22 and 24.

Albula parræ Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 339, 1846, Martinique; Bahia; Rio de Janeiro.

Albula goreensis Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 342, 1846, Gorea.

Albula neoguinaica Cuvier & Valenciennes, l. c., XIX, 350, 1846, New Guinea.

Albula seminuda Cuvier & Valenciennes, l. c., XIX, 351, 1846, New Guinea.

Albula erythrocheilos Cuvier & Valenciennes, l. c., XIX, 352, pl. 540, 1846, Friendly Islands.

Albula forsteri Cuvier & Valenciennes, l. c., XIX, 354, 1846, Tahiti.

Albula rostrata Gronow, Cat. Fishes, 189, 1854, American Ocean, etc.

Albula vulpes, Jordan & Evermann, l. c., 411, 1896.

Family XVII. CLUPEIDÆ. The Herrings.

Body oblong or elongate, more or less compressed, covered with cycloid or pectinated scales. Belly sometimes rounded, sometimes compressed, in which case it is often armed with bony serratures. Head naked, usually compressed. Mouth rather large, terminal, jaws about equal, the maxillaries forming the lateral margins of upper jaw, each composed of about three pieces. Premaxillaries not protractile; teeth mostly small, often feeble or wanting, variously arranged. Adipose eyelid present or absent. Gillrakers long and slender; gill-membranes not connected, free from isthmus. No gular plate. Gills 4, a slit behind the fourth. Branchiostegals usually few (6 to 15). Posterior lower part of opercular region often with an angular emargination, the tips of larger branchiostegals abruptly truncate. Pseudobranchiæ present. No lateral line. Dorsal fin median or somewhat posterior, rarely wanting. No adipose fin. Ventrals moderate or small. Anal usually rather long; caudal fin forked. Vertebræ 40 to 56.

The *Clupeidæ* comprise about 30 genera and 150 species, inhabiting all seas, usually swimming in immense schools; many species ascend fresh waters, and some remain there permanently. The northern and fresh-water species, as in many other families, differ from the tropical forms in having a larger number of vertebral segments.

a. Belly rounded, covered with ordinary scales; supplemental bones of maxillary very narrow; anal fin short.
b. Ventral small; teeth small, persistent, on jaws, vomer, palatines, pterygoids, and tongue.
c. Scales of breast not forming a corselet.
d. Species very small, with teeth minute; a silvery lateral band; dorsal short, of 11 to 16 rays; ventrals inserted nearly under its front.......... JENKINSIA, 22
dd. Species of moderate size, with moderate teeth; no silvery lateral band; dorsal long, of 18 to 20 developed rays; ventrals inserted much behind dorsal, much nearer base of caudal than tip of snout.......... ETRUMEUS
aa. Belly compressed, armed with bony serræ; supplemental bones of maxillary broad.
e. Anal fin moderate, of 15 to 25 rays; dorsal inserted nearly opposite ventrals.
f. Scales with their posterior margins entire and rounded; intestinal canal of moderate length.
g. Last ray of dorsal not produced.
h. Vertebræ about 50 in number (46 to 56); species of northern regions.
i. Vomer with teeth; ventral scutes weak, ventrals below middle of dorsal; vertebræ 50 to 56.......... CLUPEA
ii. Vomer without teeth.
j. Ventral scutes very weak, belly more or less rounded; vertebræ about 52; ventrals under middle of dorsal. CLUPANODON, 23
hh. Vertebræ about 42 (40 to 44); tropical species with scales large and usually firmly attached; ventrals inserted under middle of dorsal; adipose eyelid obsolete.......... SARDINELLA, 24
gg. Last ray of dorsal produced in a long filament; scales large, not firmly attached; otherwise essentially as in *Sardinella*.......... OPISTHONEMA, 25
ff. Scales with their posterior margins vertical, and pectinate or fluted; head very large; no teeth; intestines elongate; herbivorous.......... BREVOORTIA

PRISTIGASTERINÆ:
ee. Anal fin very long, of more than 30 rays; dorsal fin inserted behind ventrals.
k. Teeth not all villiform; both jaws with strong canines; ventrals present, very small.......... CHIROCENTRODON
kk. Teeth all villiform; no canines; ventral fins present.......... ILISHA, 26

Genus 22. JENKINSIA Jordan & Evermann.

Very small species, closely allied to *Etrumeus*, but with minute teeth and a silvery lateral band; dorsal with fewer than 18 rays; ventrals inserted below or just behind it. Two of the three known species are found in Porto Rico.

a. Dorsal inserted midway between snout and base of caudal; dorsal rays 14; anal 15.......... *lamprotænia*, 27
aa. Dorsal inserted nearer snout than base of caudal; dorsal rays 11; anal 17.......... *stolifera*, 28

27. **Jenkinsia lamprotænia** (Gosse).

Head 3.75; depth 5.75; eye 3; snout 3; maxillary 2.3; mandible 2.2; interorbital 5; D. 14; A. 15.

Body long, slender, and compressed; head narrow; snout long, conical, as long as the large eye; mouth large, jaws subequal, maxillary narrow, reaching slightly past anterior border of eye; minute teeth on jaws, vomer, and palatines; origin of dorsal midway between tip of snout and base of caudal, slightly in front of insertion of ventrals. Length 2 to 3 inches.

Pale straw-color; a narrow dark stripe along median line of back, and a broad silvery lateral band nearly as broad as eye.

Known only from Jamaica and Porto Rico. One specimen, 2.5 inches long, obtained.

Clupea lamprotænia Gosse, Nat. Sojourn in Jamaica, 291, pl. 1, fig. 2, 1851, Jamaica.
Jenkinsia lamprotænia, Jordan & Evermann, l. c., 419, 1896.

28. **Jenkinsia stolifera** (Jordan & Gilbert).

Head 3.75; depth 5.5; eye 2.5; D. 11; A. 17; scales caducous, about 36.

Body elongate, slender, moderately compressed. Snout sharp, tapering; jaws equal; maxillary 2.5 in head, reaching slightly beyond front of eye. Teeth minute, evident in both jaws. Eye large. Dorsal high, inserted at a point slightly nearer snout than base of candal; ventrals under fourth dorsal ray, nearly half head, and slightly shorter than pectoral.

Translucent green; side with a silvery band as in *Stolephorus*, one-fourth depth of body, a little broader than pupil; a double row of dots along back before dorsal and a single row behind; fins pale.

Found in the Gulf of Mexico from Key West to Yucatan. A small silvery fish very abundant in schools in the surf with *Stolephorus brownii*, a species it much resembles in form and coloration. Length 2 inches. Numerous specimens obtained near the shore of the reefs at Culebra Island. Most of these lack the silvery lateral band, which is replaced by a dark band, this condition appearing to be due to the formalin in which they were first preserved.

Dussumieria stolifera Jordan & Gilbert, Proc. U. S. N. M. 1884 (June 3), 25, Key West.
Jenkinsia stolifera, Jordan & Evermann, l. c., 419, 1896.

Genus 23. CLUPANODON Lacépède. The Sardines.

This genus is close to *Clupea*, which it resembles in the elongate form and weak ventral serratures. Vomer toothless; teeth in jaws mostly weak. Scales thin, deciduous. Adipose eyelid present. Gill-rakers very numerous. Species about 6; chiefly confined to the two temperate zones; all closely related to the European sardine, *Clupanodon pilchardus*, and agreeing with it in the rich and delicate flesh; less firm than that of related species, and much richer in oil. Species marine, not anadromous.

29. **Clupanodon pseudohispanicus** (Poey). *Sardina de España; "Sardina."*

Head 4; depth 3.75 to 4.5; eye 3.75.; D. 16; A. 16; scales about 45. Vertebræ 46 to 48.

Body slender, little compressed, belly scarcely carinated, its scutes not prominent; mouth small, maxillary not quite reaching pupil, 2.6 in head; gillrakers very long, slender, and numerous, 30 to 40 below angle, the longest two-thirds eye. Lower jaw with a few feeble teeth; some minute teeth on tongue. Cheek much longer than deep, their depth below eye two-thirds diameter of eye. Adipose eyelid well developed. Opercle with very faint striæ, preopercle with very few. Caudal well forked, lower lobe as long as head and a little longer than upper; ventrals inserted nearly below middle of dorsal, a little nearer base of caudal than tip of snout; pectoral 1.33 in head, a conspicuous sheath of scales at base. Intestine 1.5 times length of body.

Color, bluish with no distinct markings, sides golden and silvery; peritoneum dusky; opercle dusky within.

Found in the Gulf of Mexico from Pensacola and Tampa southward to Cuba, Jamaica, and Porto Rico; occasionally taken in numbers at Woods Hole, Mass., whither it is probably carried in the Gulf Stream. Called "sardina" in Porto Rico and "bang" in Jamaica. Length 8 inches. Specimens taken at Culebra Island.

Sardinia pseudohispanica Poey, Mem., II, 311, 1861, Cuba; Poey, Fauna Puerto-Riq., 343, 1881; Stahl, l. c., 80 and 165. 1883.
Clupanodon pseudophispanicus, Jordan & Evermann, l. c., 423, 1896.

Genus 24. SARDINELLA Cuvier & Valenciennes. Scaled Sardines.

Small herrings of the tropical seas, with the vertebræ in reduced number, about 40 to 44; scales large, usually firm and adherent, often crossed by vertical striæ. Ventral scutes strong, 25 to 35 in number. Adipose eyelid obsolete. Lower jaw projecting; upper jaw somewhat emarginate; teeth weak. Ventrals inserted behind front of dorsal. Body compressed; cheek not deep; gillrakers long and numerous; otherwise essentially as in *Pomolobus*.

The genus *Sardinella*, as here understood, covers a wide diversity of forms and may be divisible into several genera when the anatomy of the species is better known.

a. Side of body without distinct silvery lateral band; mouth moderate, teeth very small, but permanent over most of bones of mouth; scales large and usually firm.
SARDINELLA:
b. Ventral scutes 33 to 35.
c. Body slender, depth about 4.5 in length; a black opercular spot .... *anchovia*
cc. Body rather deep, depth about 3.5 in length; no black opercular spot .... *clupeola*
bb. Species imperfectly described.
d. Snout and chin black .... *apicalis*
dd. Snout and chin not black; a black humeral spot; side with dark streaks .... *bishopi*
HARENGULA:
bbb. Ventral scutes 25 to 28; body short and deep, compressed, scales usually with vertical striæ.
e. Scales not very firm and little adherent, so that many are lost in preserved examples; each scale with four vertical wavy striæ; ventral scutes about 15 + 10; depth 3.4 in length; eye 2.5 in head; no humeral spot .... *sardina*
ee. Scales firm and closely adherent so that few, if any, are lost in preserved examples; usually a humeral spot.
f. Body moderately elongate, ventral outline not strongly arched; depth 3.33 to 3.4 in length.
g. Head long, 3.43 in length; eye 2.66 in head .... *macrophthalma*, 30
ff. Body deep, ventral outline arched, forming an even curve from snout to vent; depth 2.75 to 3; eye 2.66 in head .... *humeralis*, 31
aa. Side with a very distinct lateral silvery band; scales very firm, without vertical striæ; mouth very small, almost vertical; teeth small, none on vomer; tip of snout, chin, and upper fins dusky .... *stolifera*

30. Sardinella macrophthalma (Ranzani). "*Sardina*."

Head 3.5; depth 3.4; eye 3; snout 3.4; maxillary 2.1; mandible 1.9; interorbital 4.1; D. 16; A. 17; pectoral 1.5; ventral 2.5; caudal 1.1; scales 40–10; scutes about 28.

Close to *S. humeralis* but differing in shape, chiefly in greater slenderness of body; the ventral outline is not so strongly arched, head not quite so heavy and more pointed, and in spirits the outlines of scales are less distinct. Humeral spot said (Jordan & Evermann) to be usually evident but sometimes wanting. In all our specimens it is absent. A dark, rather indistinct, longitudinal stripe from humeral region to base of upper lobe of caudal separated from the dark of the back by a pale stripe. Otherwise as in *S. humeralis*, with which it is taken.

West Indies, Cuba to Brazil; not common. Nine examples, 2.5 to 6 inches, from San Juan, Puerto Real, Culebra, and Fajardo.

Clupea macrophthalma Ranzani, Nov. Comm. Ac. Sci. Bonon., V, 320, 1842, Brazil.
Harengula maculosa Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 292, 1847, Martinique.
Harengula jaguana Poey, Repertorio, I, 169, 1866, Jagua, near Cienfuegos, Cuba.
Sardinella macrophthalmus, Jordan & Evermann, l. c., 430, 1896.

31. Sardinella humeralis (Cuvier & Valenciennes). "*Sardina*"; *Sardina Escamuda; White-bill.*

Head 3.5; depth 3; eye 2.7; snout 3.4; maxillary 2; mandible 2; interorbital 4.3; D. 16; A. 17 or 18; pectoral 1.4; ventral 2.2; caudal 1.2; scales 40–10; scutes 27 to 30. Resembling *Opisthonema*, but without the produced ray in dorsal, and with heavier head, larger eye and scales; fine teeth on jaws, palatines, and tongue; eye with a thin adipose eyelid; scales large, firm, with vertical striæ.

Blue above, silvery below; a dusky humeral spot; some golden on opercle behind eye; chin and snout dusky.

Very common and much used as food; captured extensively with the cast-net. Eighty-nine examples, 3 to 5.5 inches, collected at San Juan, Palo Seco, Mayaguez, Puerto Real, Boqueron, Arroyo, Hucares, and Culebra; one from San Geronimo.

Harengula humeralis Cuv. & Val., Hist. Nat. Poiss., XX, 293, 1847, Rio Janeiro; Bahia; Guadeloupe; Santo Domingo.
Alausa striata Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 429, 1847, Guadeloupe; Bahia.
Harengula pensacolæ Goode & Bean, Proc. U. S. N. M. 1879 (Nov. 5), 152, Pensacola, Fla.
Sardinella humeralis, Jordan & Evermann, l. c., 431, 1896.

Genus 25. OPISTHONEMA Gill. Thread-herrings.

Characters essentially those of *Sardinella*, except that the last ray of the dorsal is produced in a long filament as in *Dorosoma*, *Megalops*, and *Tarpon*. Species few, American.

32. Opisthonema oglinum (Le Sueur). *Thread Herring; Machuelo; Cailleu-Tassart; Sprat.*

Head 4.7; depth 3.2; eye 3.6; snout 3.3; maxillary 2.5; mandible 2.1; interorbital 4; D. 17 to 19; A. 23; pectoral 1.4; ventral 2.7; caudal 0.6; scales 50–15; scutes about 31.

Body much compressed below, ventral outline trenchant, much more strongly arched than dorsal; head small; mouth small, the wide maxillary reaching about to front of pupil, the lower jaw barely projecting; opercle with a deep emargination at lower angle; adipose eyelid present; fins small, last dorsal ray greatly produced, reaching base of caudal in younger individuals, somewhat shorter in older ones; pectoral fitting into a shallow depression; ventral small, with an accessory scale nearly as long as fin; anal extremely low; caudal lobes long and slender, subequal; scales large, cycloid, rather loosely attached; lateral line absent.

Color in spirits: Bluish above, silvery below, back with interrupted brownish longitudinal stripes along middle of rows of scales; a dusky shoulder-spot, the young with a series of smaller spots behind, and black-tipped caudal lobes.

West Indies, north to the Carolinas, occasionally to Massachusetts; common; 47 examples, 3.25 to 9 inches, from San Juan Market, Palo Seco, Mayaguez, Guanica, Hucares, Isabel Segunda, and Fajardo; one from San Geronimo.

Clupea thrissa Broussonet, Ichthyologie, fasc. I, 1782, Carolina; Jamaica; not of Osbeck, 1757.
Megalops oglina Le Sueur, Jour. Ac. Nat. Sci. Phila., I, 1817, 359, Newport, R. I.
Megalops notata Le Sueur, Jour. Ac. Nat. Sci. Phila., I, 1817, 359, Guadeloupe.
Chatoëssus signifer De Kay, N. Y. Fauna: Fishes, 264, 1842, New York.
Chatoëssus eumorphus Gosse, Nat. Sojourn in Jamaica, 290, 1851, Jamaica.
Opisthonemus thrissa, Poey, Fauna, Puerto-Riqueña, 343, 1881; Stahl, l. c., 80 and 166, 1883.
Opisthonema oglinum, Jordan & Evermann, l. c., 432, 1896.

Genus 26. ILISHA Gray.

Body much compressed, thorax and abdomen strongly serrated. Scales moderate; lower jaw prominent; mouth moderate with rasp-like bands of minute teeth on jaws, palatines, pterygoids, and tongue; none on vomer. Anal fin very long; ventrals present, small, inserted before the small dorsal; upper ray of pectoral strong; caudal deeply forked.

Tropical coasts of America and Asia. Only one species known from Porto Rico.

a. Anal rays 40 to 45; anal placed behind dorsal.
  b. Dorsal rays 19 or 20; eye 4 in head .... *flavipinnis*
  bb. Dorsal rays 15; eye 3.5 in head .... *bleekeriana*, 33

33. Ilisha bleekeriana (Poey). *Manjua; Anchoa Pelada.*

Depth 5.66 in length with caudal; eye 3.5; D. 15; A. 43; scutes 25; ventral line strongly curved. Mouth wide, oblique. Anal placed behind dorsal; length of anal equal to its distance from posterior border of eye. Scales very caducous. Silvery.

Matanzas, Cuba; rare. Not obtained by us, but included on the authority of Poey and Stahl.

Pellona bleekeriana Poey, Repertorio, II, 242, 1867, Matanzas, Cuba; Poey, Fauna Puerto-Riqueña, 343, 1881; Stahl, l. c., 79 and 166, 1883.
Ilisha bleekeriana, Jordan & Evermann, l. c., 436, 1896.

Family XVIII. ENGRAULIDIDÆ. The Anchovies.

Body elongate, more or less compressed, covered with thin cycloid scales. Head compressed. Mouth extremely large, more or less oblique, usually overlapped by a pointed, compressed, pig-like snout. Gape very wide, maxillary very long and slender, formed of about three pieces, extending backward far behind eye, in some species beyond head. Premaxillaries not protractile, very small, firmly joined to maxillaries. Teeth usually small, sometimes obsolete, usually fine and even, in a single row in each jaw; canines sometimes present. Eye large, well forward, without adipose eyelid. Preorbital narrow. Opercles thin and membranaceous. Gillrakers long and slender. Branchiostegals slender, 7 to 14 in number. Gill-membranes separate or joined, free from the isthmus. Pseudobranchiæ present. No lateral line. Belly rounded or weakly serrate. Fins various; dorsal usually short and median; no adipose fin; caudal forked.

Small, carnivorous shore fishes, usually swimming in large schools on sandy shores; abundant in all warm seas, occasionally entering rivers. Only one of the American genera known from Porto Rico.

a. Teeth in jaws equally small, if present; no canines.......... STOLEPHORUS, 27
aa. Teeth in jaws unequal, some of them enlarged and canine-like.......... LYCENGRAULIS

Genus 27. STOLEPHORUS Lacépède. Silvery Anchovies.

Body oblong, compressed, covered with rather large, thin, deciduous scales. Belly rounded, or weakly compressed. Snout conical, compressed, projecting beyond the very large mouth. Maxillary narrow, little movable, usually formed of three pieces extending backward far behind eye to base of mandible or beyond, not beyond gill-opening. Premaxillaries very small. Teeth small, subequal, present at all ages, usually on jaws, vomer, palatines, and pterygoids. Anal fin moderate, free from caudal (its rays 12 to 40). No pectoral filaments. Dorsal inserted about midway of body, posterior to ventrals. Pectorals and ventrals each with a large axillary scale. Adipose eyelid obsolete. Vertebræ about 40 (40 to 42) in species examined. Flesh rather pale and dry, more or less translucent; bones firm. Pseudobranchiæ present. Branchiostegals 9 to 14. Gillrakers long and slender. Gill-membranes separate, free from the narrow isthmus.

Species about 50; small, carnivorous shore fishes, swimming in large schools on sandy shores of all warm seas, occasionally entering rivers; usually marked by a very broad, distinct, silvery band.

a. Anal rays 12 to 14; body very slender, depth 6 in length; no distinct lateral band.......... *miarchus*
aa. Anal rays 15 to 17; body slender, compressed, depth 5 to 6 in length.
  b. Maxillary short, not quite reaching margin of preopercle; lateral band well defined, three-fourths eye. *perfasciatus*, 34
  bb. Maxillary of moderate length, reaching beyond preopercle nearly to gill-opening.
    c. Side with a well-defined lateral silvery band; belly not serrulate.
      d. Eye 4 in head, as long as snout; scales caducous.......... *cubanus*, 35
      dd. Eye 3.33 in head, longer than snout; axillary sheaths very large.......... *perthecatus*
aaa. Anal rays 19 to 24.
  e. Side with a distinct silvery lateral band, with well-defined edges.
    f. Maxillary long, reaching past root of mandible, nearly or quite to gill-opening; snout projecting considerably beyond lower jaw.
      g. Body moderately elongate, depth 4 to 4.75 in length of body.
        h. Silvery lateral band very sharply defined, as broad as eye or slightly narrower, not much narrowed anteriorly; eye large, 3.5 in head; belly serrulate; A. 20; gillrakers two-thirds eye.......... *brownii*, 36
      gg. Body more elongate, depth about 5.25 in length of body; gillrakers as long as eye. A. 23 or 24; eye 4.4 in head.......... *chærostomus*, 37
    ff. Maxillary short, not reaching root of mandible; eye small, not longer than snout, 4 in head; silvery stripe rather diffuse, half broader than eye; body little compressed, approaching *Engraulis mordax* in form.... *argyrophanus*
  ee. Side without distinct silvery band, or with a faint diffuse streak.
    i. Opercle short, distance from lower posterior angle of cheek to gill-opening much less than from same point forward to middle of eye; snout bluntish, not produced.
      j. Dorsal rays 12 to 14.
        k. Anal rays 18 to 20; depth 6.9.......... *lyolepis*, 38
        kk. Anal rays 23; depth 3.3.......... *garmani*, 39
      jj. Dorsal rays 15 or 16; anal 23 or 24.
        l. Depth 3.3; snout much projecting.......... *gilberti*, 40
aaaa. Anal rays about 30 (25 to 36).
  m. Silvery lateral band diffuse or obsolete; body much compressed; eye 3 to 3.5 in head.
    n. Gillrakers shorter than eye; lateral band narrow.
      o. Belly slightly serrulate; gillrakers two-thirds eye; scales caducous; anal rays 25 or 26.......... *mitchilli*
    nn. Gillrakers long and slender, longer than eye; belly trenchant, not serrate; scales 40; lateral band broad and diffuse or obsolete; snout much projecting.
      p. Snout moderately pointed; minute teeth in both jaws; lateral band diffuse.......... *clupeoides*
aaaaa. Anal fin extremely long, its rays 37 or 38. Lateral band ill defined or obsolete; snout pointed, much projecting; insertion of dorsal nearer snout than base of caudal; subopercle with a flat triangular prominence..... *spinifer*
  ll. Depth 4.3; snout little projecting.......... *poeyi*
  pp. Snout pointed; minute teeth in upper jaw only; lateral band obsolete.......... *productus*, 41

34. Stolephorus perfasciatus (Poey).

Head 4; depth 6; eye 3.7; snout 4.4; maxillary 1.5; mandible 1.5; interorbital 4.2; D. 12 to 15; A. 14 to 16; scales about 40,-7. Body very slender, the back wide, the belly compressed to a rather trenchant keel with weak serrulations; snout shorter than eye, pointed, and considerably projecting; top of head with a slight median ridge; maxillary rounded at end, shorter than in the other species, reaching not quite to edge of preopercle; front of anal under last rays of dorsal.

Color much as in *S. brownii*, the lateral band nearly as wide as eye, in spirits its upper edge bordered with dark.

Florida Keys to Cuba, Porto Rico, and Jamaica; common; 15 specimens, 2.75 to 4 inches long, from Aguadilla.

Engraulis perfasciatus Poey, Memorias, II, 313, 1861, Cuba.
Stolephorus perfasciatus, Jordan & Evermann, l. c., 441, 1896.

35. Stolephorus cubanus (Poey).

Head 5 in length, with caudal; depth 6.66; eye 4; D. 14; A. 17. Allied to *S. brownii*, but with anal shorter. Body slender, compressed. Eye as long as snout. Maxillary with teeth, its tip extending beyond opercular border. Dorsal beginning midway between front of caudal and posterior edge of eye; pectoral not quite reaching ventral. Scales caducous. A silvery band one-fourth depth of body. Length 2.75 inches. Cuba and Porto Rico. Not seen by us; included on authority of Poey and Stahl.

Engraulis cubanus Poey, Synopsis, 420, 1868, Cuba; Poey, Fauna Puerto-Riqueña, 344, 1881; Stahl, l. c., 80 and 166, 1883.
Stolephorus cubanus, Jordan & Evermann, l. c., 442, 1896.

36. Stolephorus brownii (Gmelin). *Striped Anchovy; Manjua.*

Head 3.7; depth 4.9; eye 3.5; snout 4.6; maxillary 1.1; mandible 1.4; interorbital 4.3; D. 13 to 15; A. 20 to 23; pectoral 2; ventral 2.8; caudal 1.6; scales 38,-7. Body slender but little compressed, not elevated, the dorsal outline nearly straight, the belly compressed to a not very trenchant edge; scales deciduous; snout much projecting, shorter than eye, maxillary reaching nearly to gill-opening; teeth long and slender, on both maxillary and lower jaw; dorsal and anal with a low basal sheath; front of dorsal nearer base of caudal than snout.

Translucent in life, with a very distinct and well-defined silvery lateral band, usually narrower than eye; on the caudal peduncle just before the end of the band it is slightly narrower than in the rest of its course.

Cape Cod to Brazil. The most abundant of the American anchovies; abundant in Porto Rico; 33 examples, from Palo Seco, Mayaguez, Puerto Real, Hucares, Isabel Segunda, and Fajardo.

Piquitinga, Marcgrave, Hist. Bras., 159, 1648, Brazil.
Menidia, Browne, Hist. Jamaica, 441, 1756, Jamaica.
Atherina brownii Gmelin, Syst. Nat., 1397, 1788, Jamaica; after Browne.
Esox epsetus Bonnaterre, Tabl. Ichth., 175, 1788, Jamaica; after Browne.
Engraulis lemniscatus Cuvier, Règne Animal, ed. 2, vol. 2, 323, 1829, Brazil; after *Piquitinga* of Marcgrave.
Engraulis tricolor Agassiz, Pisc. Brasil., 51, 1829, Bahia; Pará.
Engraulis piquitinga Agassiz, Pisc. Brasil., pl. 23, fig. 1, 1829, Bahia; Pará; same type as *tricolor*.
Argentina menidia Gronow, Cat., 141, 1854, Jamaica; after Browne.
Stolephorus hiulcus Goode & Bean, Proc. U. S. N. M. 1879 (March 25, 1880), 343, Clearwater Harbor, Fla.
Stolephorus brownii, Jordan & Evermann, l. c., 443, 1896.

37. Stolephorus chœrostomus (Goode). *Hog-mouth Fry.*

Head 3.5; depth 5.3; eye 4.6; snout 4.6; D. 13; A. 23; scales 38. Snout projecting much beyond lower jaw, which just passes vertical from front of eye; eye as long as snout. Maxillary tapering, reaching gill-opening. Gillrakers 10 + 25, as long as eye. Dorsal inserted before middle of body; anal under middle of body; pectoral reaching front of ventrals; scales large.

Brownish, with a lateral silvery band, as broad as eye.

This species reaches a length of 2.75 inches. Heretofore known only from Hamilton Harbor, Bermuda Islands. Apparently common about Porto Rico, specimens having been obtained by us at Hucares, Puerto Real, and Fajardo.

Engraulis chœrostomus Goode, Amer. Jour. Sci. Arts, August, 1874, 125, Bermudas.
Stolephorus chœrostomus, Jordan & Evermann, l. c., 444, 1896.

38. Stolephorus lyolepis Evermann & Marsh, new species.

Head 4.3; depth 6.9; eye 4.6; snout 4.2; maxillary 1.4; mandible 1.4; interorbital 4.4; D. 12 to 14; A. 18 to 20. Body slender and compressed, the dorsal and ventral outlines nearly alike, little arched; caudal peduncle gently tapering; no serræ evident; snout not greatly produced; maxillary with free end rounded, reaching beyond root of mandible to edge of preopercle, armed with fine teeth; lower jaw with minute teeth, smaller than those of maxillary; anal inserted under last dorsal ray; scales deciduous.

Color in spirits: Flesh-color, without silvery band, a lateral longitudinal row of small black pigment dots, which are stellate under a lens, usually more numerous posteriorly; a single row of several larger, circular black spots across opercle, and a number scattered on top of head; a row of black spots at base of anal and a few small black blotches about base of caudal rays; peritoneum with rows of black dots, these showing faintly through the flesh on the side near ventral outline between pectoral and ventral.

This species is related to *S. curtus* and *S. poeyi*, both Pacific coast species, from each of which it differs apparently in the fewer anal rays. Thirty-seven specimens of nearly uniform size were collected at Culebra, February 10, of which the type (No. 49528, U. S. N. M.) is 1.5 inches long.

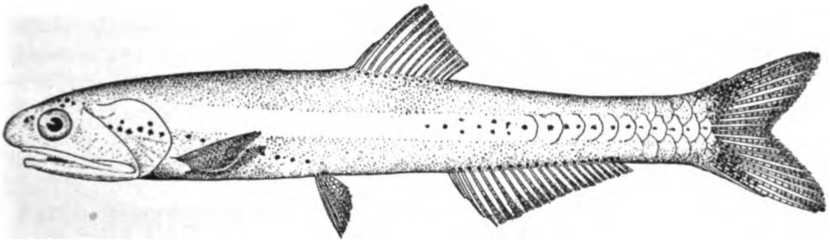

FIG. 13.—*Stolephorus lyolepis.*

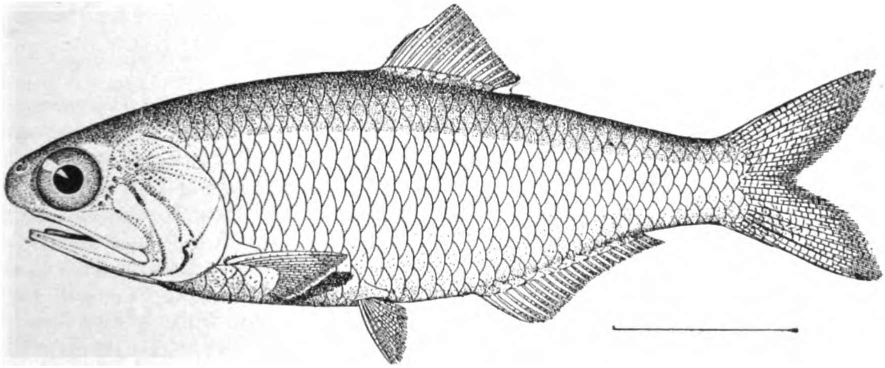

FIG. 14.—*Stolephorus garmani.*

39. Stolephorus garmani Evermann & Marsh.

Head 3.2; depth 3.3; eye 3.5; snout 5.5; maxillary 1.7; mandible 1.7; interorbital 5; D. 14; A. 23; pectoral 2; ventral 3.5; caudal 1.3; scales 42,-9.

Body comparatively deep and strongly compressed; belly not strongly trenchant, without serrulations; snout thick, much projecting; maxillary reaching nearly to root of mandible, very finely and weakly serrate; eye large; tip of lower jaw reaching vertical from front of eye; distance from lower posterior angle of cheek to vertical from posterior margin of opercle much less than from same point to eye; dorsal inserted far in advance of anal, just behind insertion of ventrals, midway between anterior edge of pupil and base of caudal.

Color in spirits: Back dark to near the median line, below this somewhat reddish; rest of body below a line from shoulder to upper base of caudal silvery; some golden on snout and behind eye; no lateral band.

This species has a general resemblance to *Stolephorus productus*, but is unquestionably distinct from it; the anal is much shorter and inserted farther back, the body is deeper, the eye larger, and the snout longer. It is very close to *Stolephorus gilberti*, differing chiefly in the larger eye, in the color of back, and in the somewhat less sharply compressed belly. One specimen, the type (No. 49360, U. S. N. M.), 4.5 inches long, collected at Puerto Real, January 27, 1899.

Stolephorus garmani Evermann & Marsh, Report U. S. F. C. 1899 (December 19, 1899), 352, Puerto Real, Porto Rico.

40. **Stolephorus gilberti** Evermann & Marsh.

Head 3.25; depth 3.4; eye 4; snout 6; maxillary 1.7; mandible 1.7; interorbital 4.9; D. 15; A. 23; pectoral 2.1; ventral 3.5; caudal 1.3; scales 42–9.

Body comparatively deep and strongly compressed, belly trenchant, without serrations; snout thick, much projecting; maxillary reaching nearly to root of mandible, scarcely serrate; eye moderate; tip of lower jaw reaching vertical from front of eye; distance from lower posterior angle of cheek to vertical from posterior margin of opercle much less than from same point to eye; dorsal inserted far in advance of anal, just behind insertion of ventrals, midway between anterior edge of eye and base of caudal.

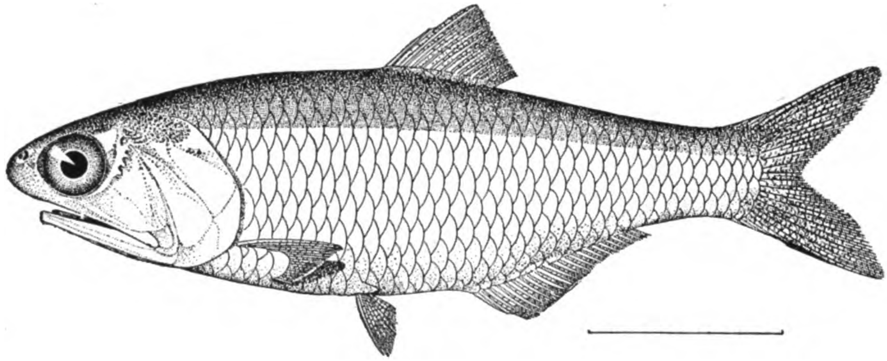

FIG. 15.—*Stolephorus gilberti.*

Color in spirits: Back light-olivaceous with dark punctulations; rest of body below a line from shoulder to upper base of caudal, silvery; faint traces of golden behind eye; no lateral band.

This species is very close to *Stolephorus garmani*, differing chiefly in the much smaller eye, the more uniform color of the back, the somewhat more sharply compressed belly, and the more nearly entire maxillary. One specimen, the type (No. 49359, U. S. N. M.), 4.5 inches long, collected at Palo Seco, near San Juan, January 13, 1899, associated with *S. productus*, with which species both *S. gilberti* and *S. garmani* Evermann & Marsh are allied.

Stolephorus gilberti Evermann & Marsh, Report U. S. F. C. 1899 (December 19), 352, Palo Seco, Porto Rico.

41. **Stolephorus productus** (Poey). *Hechudo; Grubber Broad-head.*

Head 3.6; depth 3.7; eye 3.9; snout 7; maxillary 1.3; mandible 1.4; interorbital 4.6; D. 13; A. 31 to 33; pectoral 1.75; ventral 3.3; caudal 1.1; scales 43–8.

Body elongate, not elevated, strongly compressed, belly not rounded; head small, broadest above, the pointed snout projecting beyond mouth; eye large, much greater than length of snout, placed high and well forward; mouth very wide, maxillary very long and thin, reaching to or beyond root of mandible nearly to gill-opening, ending in a point; dentition very weak, edge of maxillary being minutely serrate, no teeth in lower jaw; fins small, pectoral inserted under gill-opening, ventral very small, anal long and low, caudal deeply forked; dorsal and anal with a basal sheath of scales; no lateral line; scales large, somewhat deciduous.

Silvery on sides, the back darker, no lateral band.

Known only from Cuba, Jamaica, and Porto Rico. One of the larger anchovies; rather common; 16 specimens of about 6 inches, from Palo Seco and Ponce.

Engraulis productus Poey, Repertorio, I, 380, 1866, Cuba.
Stolephorus productus, Jordan & Evermann, l. c., 447, 1896.

Family XIX. SYNODONTIDÆ. The Lizard-fishes.

Body oblong or elongate, little compressed, covered with cycloid scales, rarely naked. Mouth very wide, the entire margin of the upper jaw formed by the long and slender premaxillaries, closely adherent to which are the slender maxillaries, the latter mostly rudimental or obsolete, never widened at tip. Teeth mostly cardiform on both jaws, tongue, and palatines; canines rarely present; large teeth usually depressible. No barbels. Opercular bones usually thin, but complete. Gill-membranes separate, free from the isthmus. Branchiostegals usually numerous. Pseudobranchiæ present. Gill-rakers tubercular or obsolete. Lateral line present. Adipose fin present, rarely obsolete; dorsal fin short, of soft rays only; pectorals and ventrals present; anal fin moderate or long; caudal forked. Skeleton rather well ossified. Air-bladder small or wanting. Intestinal canal short. Sides sometimes with phosphorescent spots or photophores. Eggs inclosed in the sacs of the ovary and extruded through an oviduct.

Genera about 10; species about 40, mostly inhabiting shore waters, some of them descending to the depths.

a. Scales present, more or less adherent.
b. Teeth of premaxillary simple, compressed, not barbed, in one or two rows; a broad band of similar teeth on palate.
c. Vent about midway between base of caudal and axil of pectoral; head short, blunt, compressed. TRACHINOCEPHALUS, 28
cc. Vent much nearer base of caudal than axil of pectoral; head depressed, with flat triangular snout ... SYNODUS, 29
bb. Teeth of premaxillary in a very broad band, curved, unequal, and barbed at the end; a similar band on palatines. BATHYSAURUS
aa. Scales very caducous or wanting; teeth in narrow bands; vent posterior.............................. BATHYLACO

Genus 28. TRACHINOCEPHALUS Gill.

This genus is closely related to *Synodus*, from which it differs chiefly in form and in the relative development of the fins. Body stout, head short, blunt, and compressed. Vent well formed, about midway between base of caudal and axil of pectoral, under tip of last dorsal ray. Teeth as in *Synodus*, but slender, smaller, and closely set. Lower jaw projecting.

Species few; shore fishes, widely diffused in tropical seas.

42. Trachinocephalus myops (Forster). *Ground Spearing; Lagarto.*

Head 3.4; depth 5; eye 6.4; maxillary 1.8; mandible 1.5; interorbital 10; D. 12; A. 14; pectoral 2.6; ventral 1.1; caudal 1.6; scales 4–58–7. Vertebræ 58; cæca 25. Snout very short, shorter than eye, lower jaw very slightly projecting; top of head scaleless, very rough; interorbital space with an abrupt longitudinal depression. Pectoral very short, ventrals long, reaching vent.

Color in spirits: Very light brown; 3 or 4 rather faint longitudinal lines above lateral line, these demarcating color stripes in life; traces of longitudinal dark lines below lateral line; back with 6 or 8 obscure dark vertical bars, barely crossing lateral line; an oblong dark-brown scapular blotch; a dark-brown band from eye across lower jaw; fins nearly plain.

One specimen, 7 inches long, from San Geronimo, collected by Mr. Geo. M. Gray.

Salmo myops Forster MS., Bloch & Schneider, Syst. Ichth., 421, 1801, St. Helena.
Osmerus lemniscatus Lacépède, Hist. Nat. Poiss., V, 236, 1803, Martinique; after Plumier.
Saurus truncatus Agassiz, Pisc. Brasil., 82, 1829, Brazil.
? Salmo trachinus Schlegel, Fauna Japonica, Poissons, 231, 1842, Japan; the East Indian, Chinese, and Japanese form, *Trachinocephalus limbatus*, is little if at all different from *T. myops*.
Saurus brevirostris Poey, Memorias, II, 305, 1861, Cuba; erroneously stated to have 10 rays.
Trachinocephalus myops, Jordan & Evermann, l. c., 533, 1896.

Genus 29. SYNODUS (Gronow) Bloch & Schneider.

First superior pharyngeals cartilaginous; second without teeth; third and fourth separate, with teeth; lower pharyngeals separate. Body elongate, subterete. Head depressed, snout triangular, rather pointed. Interorbital region transversely concave. Mouth very wide; premaxillaries not protractile, very long and strong, more than half length of head; maxillaries closely connected with them, very small or obsolete; premaxillaries with one or two series of large, compressed, knife-shaped teeth, the inner and larger depressible; palatine teeth similar, smaller, in a single broad band; lower jaw with a band of rather large teeth, the inner and larger teeth depressible; a patch of strong depressible teeth on tongue in front, and a long row along hyoid bone; jaws nearly equal in front. Eye rather large, anterior; supraorbital forming a projection above eye. Pseudobranchiæ well developed. Gillrakers very small, spine-like. Gill-membranes slightly connected. Top of head naked; cheek and opercles scaled like body; body covered with rather small, adherent, cycloid scales; lateral line present; no luminous spots. Dorsal fin short, rather anterior; pectoral moderate, inserted high; ventrals anterior, not far behind pectoral, large, inner rays longer than outer; anal short; caudal narrow, forked. Vent posterior, much nearer base of caudal than axil of pectorals. Branchiostegals 12 to 16. Stomach with a long, blind sac and many pyloric cæca. Skeleton rather firm.

Voracious fishes of moderate size, inhabiting sandy bottoms at no great depth, in most warm seas. Species numerous; two known from Porto Rico.

a. Scales large, 43 to 50 in lateral line, which has a blunt keel posteriorly.
  b. Tips of first rays of dorsal not reaching tips of last rays when depressed; snout short, broad; shoulder-girdle with a large black blotch, anal rays 10 or 11; scales 4–48–6.. *intermedius*, 43
  bb. Tips of first rays of dorsal reaching tips of last rays when depressed.
    c. Shoulder-girdle with the black spot very small or wanting; snout rather pointed, 3.75 in head; ventrals 1.25 in head; anal rays 10 to 12.................................. .... *poeyi*
aa. Scales small, 58 to 68 in lateral line.
  d. Anal fin very short, its rays 8 only; pectoral fin short.
    e. Scales moderate, 58 in lateral line; snout 4 in head; shoulder-girdle slightly dusky; dorsal mottled........ *synodus*
  dd. Anal fin moderate, its rays 10 to 13; shoulder-girdle chiefly yellowish.
    f. Snout very broad, broader than long; about 10 scales in a cross series from dorsal to ventral; jaws subequal; scales 4–60 to 64–5; tail with a slight keel .... *saurus*
    ff. Snout not broader than long; more than 10 scales in a cross series from dorsal to ventral; lower jaw included; tail not keeled.
      g. About 4 rows of scales (6 counting obliquely) between lateral line and adipose fin; scales on cheek in 4 to 7 rows.
        h. Head vermiculate above, its length 4 to 4.25 in body; 7 rows of scales on cheek............................ *fœtens*, 44

43. **Synodus intermedius** (Agassiz). *Sand Diver.*

Head 3.8; depth 7; eye 7; snout 3.8; premaxillary 1.6; mandible 1.4; interorbital 5.8; D. 11; A. 11; pectoral 2.1; ventral 1.1; caudal 1.7; scales 5–49–6. Body elongate, fusiform, slightly depressed, a slight keel on caudal peduncle; head rather blunt and heavy; scales behind eye, with tubes or muciferous canals; tips of first dorsal rays not reaching tips of last rays when depressed. Easily distinguishable from *S. fœtens* by the less slender body, heavier head, larger scales, and color markings.

Color in spirits: Grayish, paler below, each row of scales with a pale longitudinal stripe, plainest on sides; about eight faint dark vertical bars, terminating at middle of side, a dark blotch between their ventral ends, plainest in the young; pectoral, caudal, and dorsal barred; shoulder-girdle with a black blotch near angle of opercle, which covers it.

This species is generally common and ranges from southern Florida to Brazil. It is apparently the most abundant species of *Synodus* in Porto Rico, but of little value as food. Five examples, from 7 to 12 inches in length, were collected at Puerto Real, Boqueron, and Culebra.

Saurus intermedius Agassiz, in Spix, Piscium Brasil., 81, pl. XLIV, 1829, Brazil.
Saurus anolis Cuvier & Valenciennes, Hist. Nat. Poiss., XXII, 483, 1849, Bahia; Martinique.
Synodus intermedius, Jordan & Evermann, l. c., 535, 1896.

44. **Synodus fœtens** (Linnæus). *Lizard-fish; Galliwasp; Lagarto; Soap-fish.*

Head 4; depth 8; eye 8; snout 3.4; premaxillary 1.6; mandible 1.4; interorbital 5.5; D. 10; A. 12; pectorals 2.1; ventral 1.3; caudal 1.8; scales 6–60–7.

Body very slender, the caudal peduncle without trace of keel; interorbital space with radiating ridges, plainest in adult; opercles with 5 rows of scales, cheek with 7 rows.

Color in spirits: Grayish, obscurely mottled with darker on back, plain white below; no distinct longitudinal lines in adult; the young have the back more distinctly mottled, sometimes with regular bars, with diffuse regular blotches along lateral line and with more or less distinct longitudinal stripes; fins plain.

Three examples, 5.5 to 14 inches in length, from Puerto Real, Boqueron, and Isabel Segunda, and two young from Fish Hawk station 6063 in Mayaguez Harbor, in 75 fathoms.

Salmo fœtens Linnæus, Syst. Nat., ed. XII, 513, 1766, South Carolina.
Osmerus albidus Lacépède, Hist. Nat. Poiss., V, 229, 1803, Carolina; after Linnæus.
Coregonus ruber Lacépède, Hist. Nat. Poiss., V, 263, 1803, Martinique; after Plumier.
Esox salmoneus Mitchill, Trans. Lit. and Phil. Soc., I, 1815, 442, New York.
Saurus longirostris Agassiz, Spix, Pisc. Brasil., pl. 43, 1829, Brazil.
Saurus mexicanus Cuvier, Règne Animal, ed. II, vol. 2, 314, 1829, Mexico.
Saurus spixianus Poey, Memorias, II, 304, 1861, Cuba.
Synodus fœtens, Jordan & Evermann, l. c., 538, 1896.

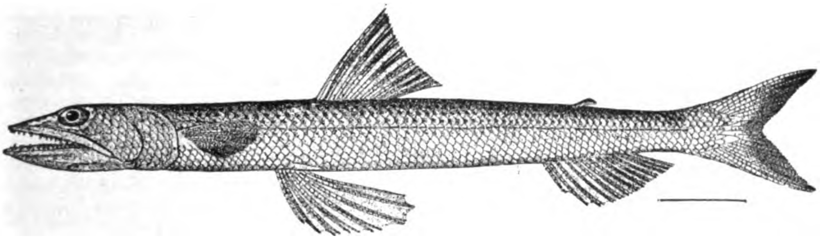

FIG. 16.—*Synodus fœtens.*

Family XX. AULOPIDÆ.

Allied to the *Synodontidæ*, but with the maxillary separate, well developed, and dilated behind. Hypocoracoids extended downward, as in many spiny-rayed fishes. Gillrakers mostly long and slender, needle-shaped. Eyes normal, large or small. No luminous spots; jaws without fang-like teeth. Dorsal fin moderate, nearly median in position; body elongate. Pectorals present, normal in form and position; adipose fin normally present. Pseudobranchiæ present.

Fishes of moderate depths, chiefly Atlantic, including, as here understood, about six species.

Genus 30. CHLOROPHTHALMUS Bonaparte.

Head elongate, body subterete, covered with moderate-sized, adherent, pectinate, or ctenoid scales arranged in straight, parallel, oblique lines. Mouth rather large, maxillary well developed, dilated behind, reaching to beyond front of orbit; lower jaw projecting. Teeth very small, sharp on jaws, vomer, and palatines, usually minute teeth on tongue. Eye very large. Dorsal short, inserted before middle of length of body; adipose fin small; anal short; caudal forked; pectorals and ventrals well developed, ventrals inserted under the dorsal and not far behind pectorals, none of the rays forming exserted filaments. Gill-openings wide. Branchiostegals 10. Pseudobranchiæ well developed. Gillrakers needle-shaped, rather numerous.

Color, silvery, with darker markings.

Deep-sea fishes, resembling smelt. Of four known species, only one is from Porto Rico.

a. Eye 2 in head; scales 60 to 63 .... *agassizii*
aa. Eye 3 in head; scales 45 to 52.
  b. Dorsal rays 11; depth 6.25 in length .... *chalybeius*, 44
  bb. Dorsal rays 8; depth 5.5 in length .... *truculentus*

45. Chlorophthalmus chalybeius (Goode).

Head 3; depth 6; eye 2.5; snout 3.5; interorbital 7; maxillary 2; mandible 1.8; D. 9; A. 6; scales 51; pectoral 1.5; ventrals 1.6; height of dorsal 1.4; of anal 2.5; length of caudal lobes 1.4; least depth of caudal peduncle about half that of body.

Body terete; head rather large; mouth large; maxillary long, broad at tip, reaching front of pupil; lower jaw somewhat projecting; eye very large; minute teeth on jaws, vomer, palatines, and tongue;

gillrakers long and slender; opercular flap long, reaching base of pectoral. Scales large, arranged in regular, oblique, transverse rows, overlapping in such a manner as to resemble plates, most of the scales apparently cycloid, but those of lateral line pectinate. Origin of caudal slightly nearer tip of snout than adipose fin and in front of base of ventrals; adipose fin over middle of anal whose distance from snout is three-fourths length of body; pectoral long, pointed, its tip not reaching tips of ventrals; ventrals long; anal opening between ventrals and near their base.

Color in alcohol: Pale; back and sides crossed by about 10 rather broad dark-brown bars, usually interrupted on the side, the broadest being just back of dorsal; a broad one crossing front of dorsal, and a narrow one at its last rays; a large quadrangular dark blotch on side above and anterior to anal fin; base of caudal dark; cheek, opercles, and top of head with some dark; snout pale; lower part of side, especially between pectoral and ventral, with fine black specks; a few above pectoral; breast and region between ventrals with numerous shining black specks; anal black; scales of belly with rows of similar black specks; bases of anal and ventrals similarly marked; inner ventral rays black; lower part of anterior dorsal rays black; base of caudal with numerous dark specks.

The single specimen (2.5 inches long) which we have agrees fairly well with the type with which we have compared it. The lower jaw, however, is less projecting in our specimen and the dorsal rays are one fewer. The known specimens of this interesting species have been taken as follows:

Fish Hawk Station.	U.S. Nat. Mus. No.	Lat. N.	Long. W.	Depth.	Albatross Station.	U.S. Nat. Mus. No.	Lat. N.	Long. W.	Depth.
		° ′ ″	° ′ ″	Fms.			° ′ ″	° ′ ″	Fms.
876 877 878	26092	Off Block Island.		126	2420....... 2424....... 2425.......	43829 43830 43831	37 03 20 36 41 37 36 20 24	74 31 40 74 42 15 74 46 30	104 85 119
1043.......	28995	38 39 00	73 11 00	130	2536.......	43833 43834	39 56 15	70 47 30	157
1038.......	28976	39 58 00	70 06 00	146					
1108.......	31644	40 02 00	70 37 30	101	2537.......	43835	39 56 45	70 50 30	156
6070.......	....	Mayaguez Harbor.		220					

It will be observed that all the specimens previously taken were obtained in the Gulf Stream southeast of Rhode Island, in depths ranging from 85 to 157 fathoms. The specimen obtained by us in Mayaguez Harbor was taken from rocky bottom in the beam trawl and at the greatest depth yet known for the species.

Hyphalonedrus chalybeius Goode, Proc. U. S. N. M. 1880 (Feb. 16, 1881), 484, Gulf Stream, off Block Island.
Chlorophthalmus chalybeius, Jordan & Evermann, l. c., 542, 1896.

Family XXI. PŒCILIIDÆ. The Killi-fishes.

Body oblong or moderately elongate, compressed behind, depressed forward, covered with rather large cycloid scales, which are adherent and regularly arranged. Lateral line wanting or represented by a few imperfect pores. Head scaly, at least above. Mouth terminal, small, the lower jaw usually projecting; margin of the upper jaw formed by the premaxillaries only; premaxillaries strong, extremely protractile. Teeth incisor-like or villiform, sometimes present on vomer, but usually in jaws only; lower pharyngeals separate, with cardiform or rarely molar teeth; third upper pharyngeal enlarged, fourth wanting or united to third. Gill-membranes somewhat connected, free from isthmus; gillrakers very short, thick. Branchiostegals 4 to 6. Pseudobranchiæ none. Dorsal fin single, inserted posteriorly, of soft rays only, rarely with a single spine or a rudimentary spinous dorsal; caudal fin not forked; ventral fins abdominal, rarely wanting; pectoral fins inserted low; no adipose fin. Stomach siphonal without pyloric appendages. Air-bladder simple, often wanting. Basis cranii simple (*fide* Cope). Sexes usually unlike, the fins being largest in the males, but in some species the females are much larger in size. Many of the species are ovoviviparous or viviparous, the sexes very unlike, anal fin of male being developed as an intromittent organ, the young well developed at birth.

A large family of brackish or fresh-water fishes in southern Europe, Asia, Africa, and America, some of them occurring in bays and arms of the sea. They are mostly of small size, and the species are very difficult of determination. Only two species known from Porto Rico. This is easily understood when it is remembered that there is so little brackish water about this island.

a. Intestinal canal comparatively short, little convoluted; teeth little movable; bones of the dentary firmly connected; lower jaw strong and usually projecting beyond upper; species chiefly carnivorous.

b. Anal fin of male similar to that of female and not modified into an intromittent organ. Species oviparous.

c. Teeth all pointed, none of them compressed or bicuspid or tricuspid.

FUNDULINÆ:

d. Teeth in villiform bands or at least in more than one series.

e. Air-bladder well developed (in all species examined); no caudal ocellus.

f. Gill-openings not restricted above, the opercular angle free from shoulder-girdle; body oblong; dorsal various in size and insertion .... FUNDULUS, 31

ff. Gill-openings restricted, the opercle from upper root of pectoral upward being adnate to shoulder-girdle, body short and deep .... ADINIA

ee. Air-bladder wanting; a black ocellus at root of caudal, at least in males .... RIVULUS

dd. Teeth arranged in a single series; dorsal inserted in advance of anal; mouth oblique.

g. Dorsal and anal fins short, each of 9 to 13 rays .... LUCANIA

gg. Dorsal and anal fins very long, each of more than 20 rays .... GIRARDINICHTHYS

CYPRINODONTINÆ:

cc. Teeth incisor-like, notched, bicuspid or tricuspid.

h. Ventral fins well developed (occasionally lost through atrophy); gill-openings restricted; opercle adnate above to the shoulder-girdle.

i. Incisors bicuspid, with a band of villiform teeth behind them; body rather deep, vertical fins moderately developed .... CHARACODON

ii. Incisors tricuspid, in one row, with no villiform teeth behind them; body short and deep, compressed.

j. Dorsal fin short, of 10 to 12 rays, first ray slender and rudimentary .... CYPRINODON

jj. Dorsal fin very long, of 16 to 18 rays, first ray developed as a stout, grooved spine .... JORDANELLA

bb. Anal fin in the males placed well forward and modified into a sword-shaped intromittent organ teeth all pointed, arranged in bands. Species viviparous or ovoviviparous, the young of large size at birth.

GAMBUSIINÆ:

k. Eye normal, pupil not divided by a partition; dorsal inserted more or less behind front of anal.

l. Jaws not produced into a beak, lower jaw prominent, longer than upper; male fish much smaller than female.

m. Dorsal fin long, of 14 to 16 rays; anal short .... PSEUDOXIPHOPHORUS

mm. Dorsal fin short, of 6 to 10 rays; anal short .... GAMBUSIA

ll. Jaws produced into a moderate beak, much as in *Labidesthes;* dorsal and anal short .... BELONESOX

ANABLEPINÆ:

kk. Eye divided into two portions by a horizontal cross partition; vertical fins short; body elongate .... ANABLEPS

aa. Intestinal canal elongate, with numerous convolutions; dentary bones loosely joined; teeth movable; species chiefly mud-eating.

GOODEINÆ:

n. Teeth incisor-like, all tricuspid, in one series, with a series of villiform teeth behind them; sexual characters unknown, the sexes probably alike; lower jaw projecting.

o. Fins small; scales large; form oblong .... GOODEA

PŒCILIINÆ:

nn. Teeth all pointed; anal fin in male advanced and modified into an intromittent organ; lower jaw short and weak. Species ovoviviparous.

p. Teeth in a single series; dorsal and anal both short; scales large.

q. Dorsal fin inserted in advance of anal .... PLATYPŒCILUS

qq. Dorsal fin inserted more or less behind front of anal .... HETERANDRIA

pp. Teeth in more than one series.

r. Dorsal inserted more or less behind anal; both fins very small .... LEBISTES

rr. Dorsal inserted over or in advance of anal, its rays much elevated in male.

s. Dorsal fin short, of fewer than 12 rays.

t. Teeth of inner series in both jaws trifid .... ACROPŒCILIA

tt. Teeth of inner series in both jaws entire .... PŒCILIA, 32

ss. Dorsal fin long, of 12 to 16 rays.

u. Caudal fin normal, alike in both sexes, or with the lower angle merely sharp in the male .... MOLLIENISIA

uu. Caudal fin in males with its lower lobe much produced and sword-shaped, in adult as long as the rest of the body .... XIPHOPHORUS

Genus 31. FUNDULUS Lacépède. Killi-fishes.

Body rather elongate, little elevated, compressed behind. Mouth moderate, lower jaw projecting. Jaws each with two or more series of pointed teeth, usually forming a narrow band. Bones of the mandible firmly united. Scales moderate. Gill-opening not restricted above, opercle with its margin not adnate to shoulder-girdle. Preopercle, preorbital, and mandible with mucous pores. Dorsal and anal fins similar, small or rather large, dorsal inserted either in front of, above, or behind front of anal; ventrals well developed. Air-bladder present. Sexes differing in color, size, and development of fins, anal fin in the male normal. Intestinal canal short. First superior pharyngeal without teeth, second with teeth; third and fourth coossified, with teeth.

Species very numerous, mostly American, inhabiting fresh waters and arms of the sea. They are the largest in size of the cyprinodonts, and some of them are very brightly colored. They are oviparous and feed chiefly on animals. Some of them are bottom fishes, burying themselves in the mud of estuaries; others swim freely in river channels and bays; still others are "top minnows," surface swimmers, feeding on floating insects in swamps and streams.

a. Species with dorsal fin moderate or rather large, of 11 to 17 rays, its insertion above or usually in front of insertion of first ray of anal; scales large or small. Free-swimming species, not feeding at the surface, some of them often burying themselves in the mud of bottoms in shallow water.
b. Dorsal fin inserted before origin of anal; branchiostegals 5 or 6.
FUNDULUS:
c. Scales large, 31 to 38 in a lengthwise series.
d. Scales in lateral line 31 to 34, 10 to 12 in a cross series; body rather elongate, depth 4 to 4.5 in length; dorsal rays usually 12.
e. Body without crossbands; each scale above, and especially posteriorly, with a vertical purplish spot in the center; dorsal with series of blackish dots; anal rays 13 .... *punctatus*
ee. Body with crossbands light or dark, probably in both sexes; anal rays 9 to 11.
f. Snout shortish, shorter than eye; a black spot on back before dorsal; head bluntish, 3.5 in length.......... *pallidus*
ff. Snout very long, 1.5 times length of eye in adult; no black spot before dorsal; male with an ocellated dorsal spot; head pointed and elongate, 3.33 in body; branchiostegals 6.......... *similis*
dd. Scales in lateral line 35 to 38.
g. Anal rays 10 to 12.
h. Female with two or three black horizontal stripes; male with about 12 dark crossbars and a dorsal ocellus; head long; 3.75 in length; branchiostegals 6.......... *majalis*
hh. Female plain or with dark crossbands only; no black horizontal stripes.
i. Dorsal rays 10 or 11.
j. Color greenish; both sexes usually with dusky or silvery crossbars and pearly spots, at least on the fins of the male; dorsal sometimes with an ocellus; scales 35 or 36.
k. Form robust, the depth 3.66 in length; head 3.66; dorsal ocellus faint or wanting; males with many pearly spots; females nearly plain .... *heteroclitus*
kk. Form rather slender, the depth 4 in length; head 3.25; dorsal ocellus on female very conspicuous; pearly spots fewer; female banded or spotted.......... *occllaris*
jj. Color greenish; in spirits without bands or spots; body deep; tail slender; fins small .... *fonticola*, 46
ii. Dorsal rays 12 to 14; olivaceous, with about 15 dark crossbands .... *bermudæ*
gg. Anal rays 16 or 17; dorsal rays 13 or 14; upper lip thick; scales 38-15 or 16.
l. Form robust, the depth in adult about 3 in length; color uniform pale-brown; fins unspotted .... *robustus*
ll. Form rather slender, the depth 4.5 in length; color uniform-brown, or slightly mottled on tail; fins unspotted; the anal of male black at base, yellow distally.......... *labialis*
cc. Scales comparatively small, 44 to 48 in lateral line; dorsal fin of 13 to 15 rays; anal rays 11 to 14.......... *adinia*
bb. Dorsal fin inserted over or slightly behind front of anal fin; branchiostegals 4 or 5; bright-colored species with orange or brown spots, inhabiting mountain springs and brooks; scales about 35, 24 before dorsal; body with about 15 well-marked black crossbands, as in *Fundulus similis* or *F. cingulatus*, between which this species seems to find its place; fins plain. D. 9 or 10; A. 9.......... *funduloides*
ZYGONECTES:
aa. Species with dorsal fin small, of 7 to 11 rays, its insertion distinctly behind front of anal fin; small species with large scales (29 to 40); surface swimmers, "top minnows," seeking insects at the surface of water.
m. Anal rays 14; dorsal rays 8; scales 31-8; depth 5 in length; olive, the body plain; dorsal and anal with dark crossbands; base of caudal with round pale spots .... *dovii*
mm. Anal rays 8 to 13.
n. General coloration olivaceous, either plain or with pearly or orange spots paler than ground-color, or blackish spots not forming distinct series; no sharply defined black crossbars or longitudinal black stripes.
o. Anal rays 12 or 13; body slender, depth 4 to 5 in length .... *jenkinsi*
oo. Anal rays 8 to 11; scales rather large, about 33 to 35-10; depth about 4 in length; anal rays 8 to 11; head 3.25 to 3.5 in length .... *pulvereus*
nn. General coloration olivaceous, with a single black lateral stripe from head to tail; body stout, depth 3.33 in length; sides silvery, with black lateral shade above silvery part. D. 11; A. 11; scales 31-10.......... *melapleurus*

46. **Fundulus fonticola** Cuvier & Valenciennes.

D. 11; A. 12; B. 5; scales 37. Body plump, with long caudal peduncle. Head broad, little depressed; tail slenderer and body deeper than in *Fundulus heteroclitus;* dorsal inserted in front of anal; dorsal and caudal small and rounded, anal high and pointed, paired fins short. Teeth in broad bands, outer little enlarged. Uniform green, apparently without spots or band in spirits. (Color entirely lost in the original type.) Length 2 inches.

Known only from mountain springs in Porto Rico; here described from the original type, the only known example, as the other specimens possessed by Cuvier & Valenciennes belong to a species of *Gambusia*. This species was not obtained by us, but is recorded from Porto Rico by Poey.

Fundulus fonticola Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 198, 1846, Porto Rico; Poey, Fauna Puerto-Riqueña, 342, 1881; Jordan & Evermann, l. c., 643, 1896.

Genus 32. **PŒCILIA** Bloch & Schneider.

Body oblong, often rather deep; mouth small, transverse, with weak jaws; teeth small, in narrow bands, the outer series in each jaw being usually enlarged, curved, movable, and with brown tips; lower jaw not prominent, bones movable. Scales large. Dorsal fin rather small, of 7 to 11 rays; anal fin short, in female nearly opposite dorsal, in males advanced and modified into a sword-shaped intromittent organ. Vertebræ about 28. Intestine long.

Numerous species, mud-eating and viviparous, inhabiting the West Indies, Mexico, and South America. The genus differs from *Mollienisia* only in the smaller size of the dorsal, which usually has 9 or 10 rays and is nearly opposite the anal in the female, but behind it in the male.

a. Scales very large, 23 to 25 in a lengthwise series; coloration plain; dorsal and anal dotted.
  b. Dorsal rays 7; anal rays 8; coloration plain, fins dotted .... *vivipara*, 47
  bb. Dorsal rays 9; anal rays 8 .... *gilli*
aa. Scales moderate, 28 to 32 in a lengthwise series.
  c. Base of caudal with a black ocellus .... *pavonina*
  cc. Base of caudal without distinct black ocellus.
    d. Dorsal and anal each with 10 or 11 rays; scales 30 to 32,-10; depth 3 to 3.33 in length; side with two rows of black dots .... *vittata*
    dd. Dorsal with 7 to 11 rays; anal rays 6 to 9.
      e. Body rather robust, depth in adult more than one-fourth length .... *mexicana; thermalis; chisoyensis; petenensis; sphenops; dovii; boucardi; vandepolli; dominicensis; melanogaster; spilurus*
      ee. Body rather elongate, depth in adult not more than one-fourth length .... *elongata*

47. **Pœcilia vivipara** (Bloch & Schneider).

Head 3.6; depth 3.5; eye 3.5; snout 4.2; interorbital 1.8; D. 7; A. 8; scales 25,-8.

Body stout, compressed posteriorly; head depressed, flat; mouth small, jaws weak, lower projecting; teeth small, in a narrow band in each jaw, outer series greatly enlarged, curved, movable, tips brown, those of inner series of short, blunt papillæ; greatest width of body at pectorals about 1.2 in head; caudal peduncle greatly compressed 7 or 8 times in its least depth; origin of dorsal fin in female somewhat posterior to that of anal, a little nearer snout than tips of caudal fin; dorsal and anal fins small, the rays short; pectorals and ventrals short; scales large; intestinal canal long and convoluted.

Color, olivaceous, paler below; borders of scales brownish; a dark bar across anterior part of opercle, meeting its fellow below; dorsal fin with a broad black bar, plainest on posterior rays, sometimes not evident on anterior rays; caudal with many fine dark specks, faint traces of two dark crossbars; an irregular black blotch on base of upper caudal rays and a similar one on lower, these sometimes indistinct. The males differ somewhat from the females in color. The black at the base of the caudal is more distinct, and the body is crossed by some 10 or 12 indistinct brownish bars.

The male also differs from the female in having the anterior rays of the anal modified into a long, somewhat curved intromittent organ, the length of which is usually about equal to length of head; the anal is situated much farther forward, its origin being nearer tip of snout than base of caudal; the ventrals are also much lengthened, about 1.3 in head.

This little fish has been recorded from Brazil, Guiana, and Martinique. It was found near Ponce and Fajardo and at Arroyo and Hucares. At the latter place 422 specimens were obtained February 14 in a small brackish-water lagoon, where it was associated with *Dormitator maculatus* and the young of *Tarpon atlanticus*. They most frequented the shallow water along the edges of the lagoon, where they swarmed in great numbers and were easily caught in a small hand-net. Of the 422 examined only 34 were males. The largest females are about 2 inches in total length, the males about 1.44 inches. At Fajardo 71 were taken, of which only one was a male. These were evidently adults, some being 3 inches long and most of them over 2 inches. Some of the females contained well-developed young.

Pœcilia vivipara Bloch & Schneider, Syst. Ichth., 452, pl. 86, fig. 2, 1801, Surinam; Jordan & Evermann, l. c., 691, 1896.
Pœcilia surinamensis Cuvier & Valenciennes, Humboldt, Observ. Zool., II, 158, 1817, Surinam.
Pœcilia schneideri Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 135, 1846, Surinam.

Family XXII. ESOCIDÆ. The Needle-fishes.

Body elongate, very slender, compressed or not, covered with small thin scales. Lateral line very low, running as a fold alongside of belly. Both jaws produced in a beak, the lower jaw the longer, very much the longer in the young, which resemble *Hemiramphus;* maxillaries grown fast to premaxillaries; each jaw with a band of small, sharp teeth, besides a series of longer, wide-set, sharp, conical teeth. No finlets. Dorsal fin opposite anal, both fins rather long. Air-bladder present. Lower pharyngeals united to form a long, slender, narrow plate, with flat surface, covered with small, pointed teeth; upper pharyngeals distinct, the third pair little enlarged, each with some 15 moderate, unequal pointed teeth (*Tylosurus marinus*); fourth pair well developed, with similar teeth, but without anterior processes. Vertebræ numerous, with zygapophyses. Ovary single.

Voracious, carnivorous fishes, bearing a superficial resemblance to the gar pikes; found in all warm seas, sometimes entering rivers.

This family contains 4 genera, only 2 of which (*Tylosurus* and *Athlennes*) are found in our waters, and only the first is represented in Porto Rico; the species are about 50, the majority of them American. Their habits are ordinarily much like those of the pike, but when startled they swim along the surface with extraordinary rapidity, often leaping above the water for short distances. When thus leaping the large species of the tropics are sources of danger to incautious fishermen, sometimes piercing the naked abdomen of the savages. Most of them are good food-fishes, but the green color of the bones of the larger species often causes them to be avoided, for no good reason.

a. Gillrakers none; no teeth on vomer; dorsal and anal elevated in front; caudal fin lunate.
b. Body subterete or slightly compressed, its breadth more than two-thirds its greatest depth.......... TYLOSURUS, 33
bb. Body much compressed, its breadth not half its greatest depth.......... ATHLENNES

Genus 33. TYLOSURUS Cocco. The Hound-fishes.

Body elongate, very slender, not much compressed. Both jaws prolonged into a beak, lower jaw somewhat the longer, much the longer in young fishes, the very young resembling *Hemiramphus*. Each jaw armed with a band of small, sharp teeth, beside which is a series of longer, wide-set, sharp, conical, unequal teeth; no teeth on vomer or palatines. Scales small, thin; lateral line running along the side of the belly, becoming median on the tail. No finlets. Dorsal fin more or less elevated anteriorly; caudal fin short, unequally lunated or forked; pectorals moderate; ventrals small, inserted behind the middle of the body. Gillrakers obsolete. Bones usually more or less green.

This genus contains numerous species of comparatively large size. Voracious fishes, chiefly American, one species crossing to Europe, some of them entering rivers.

a. Mouth capable of being nearly or quite closed, upper jaw not conspicuously arched at base.
b. Caudal peduncle compressed, deeper than broad, without trace of keel along the lateral line; no fold of skin across preopercle; caudal subtruncate, the lower lobe somewhat produced; sides with a bluish-silvery band; species of small size, with scales and bones not green.
c. Scales comparatively large, about 85 before the dorsal fin, and about 7 or 8 rows on the cheek; body robust, depth about 5 in head; coloration pale, dorsal and caudal brick-red in life; lateral stripe narrow for its entire length; no scapular blotch.......... *notatus*
cc. Scales small, 140 to 150 before dorsal fin, about 12 rows on the cheek; body slender; ventrals inserted at a point nearer cheeks than base of caudal; fins without red; lateral stripe broadened below dorsal fin.
d. Body very slender, depth 7 in head, which is 2.83 in body; eye moderate, 2.33 to 2.75 in postorbital part of head; no distinct notch in the temporal ridge; maxillary not entirely concealed by preorbital. D. I, 15; A. I, 17; scales in lateral line 225.......... *timucu*, 48
dd. Body less slender, depth 6 in head, which is 2.9 in body; eye large, 2.2 in postorbital part of head; a distinct notch on temporal ridge close behind eye; maxillary almost entirely concealed by the preorbital. D. I, 15; A. I, 17; scales in lateral line 200.......... *euryops*
bb. Caudal peduncle very much depressed, wider than deep, but without trace of keel. Head 2.66 in length; eye 2.5 in postorbital part of head; maxillary nearly concealed by preorbital; body subterete; snout very nearly twice length of rest of head; brownish above, silvery below, a bluish lateral stripe edged below with black and yellowish; scales not very small. D. 16; A. 17.......... *diplotænia*
bbb. Caudal peduncle more or less depressed, or at least with a more or less developed dermal keel along the lateral line; scales and bones more or less green.
e. Dorsal and anal fins short, each of 14 to 18 rays, anal larger than dorsal and beginning farther forward; last rays of dorsal and anal low; jaws slender, about twice as long as rest of head, no fold of skin across preopercle.
f. Eye very small, 4 to 6 in postorbital part of head; caudal keel sharp, color black; body and tail much depressed, *microps*

ff. Eye moderate, 2 to 3.25 in postorbital part of head.

g. Caudal fin forked; caudal keel sharp, broad, and conspicuous; top of head flat, striated, without median groove; base of upper jaw much depressed; maxillary entirely hidden by preorbital; teeth very small; ventral fin midway between eye and caudal; scales not very small. D. I, 13; A. I, 18 .... *ardeola*, 49

gg. Caudal fin unequally lunate, the emargination not deep, the lower rays moderately produced; scales very small; sides with a silvery lateral stripe; caudal keel not very conspicuous, not black; top of head with median groove, maxillary not entirely concealed by preorbital; ventral inserted midway between preopercle and base of caudal. Species of moderate size, with the scales and bones more or less green.

h. Eye moderate, 2.5 in postorbital part of head; pectorals not black posteriorly. D. I, 15; A. I, 17; lateral line 300; a dark bar on opercle .... *marinus*

hh. Eye small, 3.25 in postorbital part of head. D. 13 or 14; A. 15 or 16; pectoral pale .... *almeida*

ee. Dorsal and anal fins long, each of 17 to 25 rays, last rays of dorsal fin more or less elevated in the young, becoming lower in adult; caudal keel rather strong, black; one or more folds of skin across edge of preopercle; caudal fin deeply emarginate or unequally forked. Ventrals inserted midway between base of caudal and middle of eye. Species of large size, with scales and bones green; no distinct lateral stripe.

i. Beak short and very strong, its length 1.5 to 1.83 times length of rest of head; body comparatively robust, depth more than one-fifth length of head.

j. Dorsal fin long, its rays I, 21 to I, 24; anal rays I, 22 to I, 24; insertion of dorsal almost opposite that of anal; snout longer, 1.66 to 1.83 length of rest of head; lateral line about 350 .... *raphidoma*, 50

jj. Allied to *T. raphidoma*, but insufficiently characterized .... *galeatus*

ii. Beak strong, but more elongate, about twice length of rest of head; dorsal beginning behind front of anal; greatest depth of body about two-thirds length of pectoral. D. I, 23; A. I, 21; lateral line 380; no lateral stripe ..... *acus*

aa. Mouth not closing completely, upper jaw arched at base; lobes of dorsal and anal low, the last rays elevated; eye very large, 2.1 in head; scales small, green. D. 24; A. 22; a bluish lateral band .... *caribbæus*

48. **Tylosurus timucu** (Walbaum). "*Agujon.*"

Head 2.75; depth 7; eye moderate 2.33 to 2.75 in postorbital part of head; scales small, 225, about 150 before dorsal: D. 15; A. 17. Body very slender, subterete; caudal peduncle not keeled; ventrals inserted nearer cheeks than base of caudal. No distinct temporal notch; maxillary not entirely concealed. Scales and bones not green. Greenish; a silvery-bluish lateral band, widened below dorsal; no scapular spot. Length 1½ feet. Florida Keys to Brazil; not rare.

Found by us at San Juan, Palo Seco, and Hucares, and doubtless occurring everywhere about the island. By the natives all the species of *Tylosurus* are known as "agujon."

Timucu or ***Peixe agulha***, Marcgrave, Pisc. Brasil., 168, 1648, Brazil.
Esox timucu Walbaum, Artedi Piscium, III, 295, 1792, Brazil; after Marcgrave.
Belone subtruncata Poey, Memorias, II, 295, 1861, Havana.
Belone depressa, Poey, Memorias, II, 296, 1861, Havana.
Tylosurus sagitta Jordan & Gilbert, Proc. U. S. N. M. 1884, 25, Key West.
Tylosurus timucu, Jordan & Evermann, l. c., 711, 1896.

49. **Tylosurus ardeola** (Cuvier & Valenciennes). "*Agujon.*"

Head 3.75; depth 8 in head; eye 7; lower jaw from eye 4 in eye (upper jaw broken in our specimen); interorbital equal to eye; D. 13; A. 17. Body very slender; head broad and flat, much broader than in a specimen of *T. timucu* of same size; upper jaw depressed; preorbital completely covering maxillary; teeth small and weak; no fold of skin on opercle; caudal peduncle depressed, with a strong sharp keel; scales moderate, about 150 before dorsal; origin of dorsal decidedly behind that of anal; caudal unequally lunate, lower lobe the longer; ventrals midway between eye and caudal.

Our collection contains a specimen of *Tylosurus*, 13 inches long, obtained at Isabel Segunda, which we are not able to identify with certainty. It is much emaciated and starved in appearance, with very short jaws, which have probably been broken. It seems to agree with the brief description given by Cuvier & Valenciennes of their *Belone ardeola* and also of their *B. cigonella*, the type of which came from Porto Rico.

Belone ardeola Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 425, 1846, Martinique.
Belone cigonella Cuv. & Val., Hist. Nat. Poiss., XVIII, 436, 1846, Porto Rico; Poey, Fauna Puerto-Riqueña, 337, 1881.
Tylosurus ardeola, Jordan & Evermann, l. c., 713, 1896.

50. **Tylosurus raphidoma** (Ranzani). "*Agujon*"; *Hound-fish.*

D. 21 to 24; A. 22 to 24; scales 350. Caudal keel rather strong, black; one or more folds of skin across edge of preopercle. Body robust, little compressed, its greatest breadth a little more than two-thirds greatest depth; caudal peduncle slightly depressed, a little broader than deep, with a slight black dermal keel. Head broad, interorbital space nearly two-thirds length of postorbital part of head, with a broad, shallow, nearly naked median groove, which is wider behind and forks at nape. Supraorbital bones with radiating striæ. Jaws unusually short, stiff, strong, rapidly tapering forward; large teeth of jaws very strong, knife-shaped. Upper jaw from eye about 1.75 times as long as the rest of head. Eye large, 7 in snout, 2.66 in postorbital part of head, and 1.8 in interorbital width. Maxillary entirely covered by preorbital. Cheek densely scaled; opercle mostly naked except along the anterior margin. Scales of body minute, especially above. Dorsal fin low posteriorly, height of its anterior lobe equaling that of anal, or length of postorbital part of head, its longest ray two-fifths the base of fin; last rays of dorsal and anal much elevated in young; caudal lunate, its lower lobe nearly half longer than upper; middle rays about as long as eye. Ventrals inserted midway between base of caudal and middle of eye, their length a little less than that of pectoral and equal to postorbital part of head; insertion of anal opposite that of dorsal.

Green, silvery below; no lateral stripe; pectoral and dorsal blackish; scales and bones green.

This species reaches a length of 3 to 5 feet, and is generally abundant in the West Indies from the Florida Keys to Brazil, the young occasionally reaching northward, having been reported by Dr. Bean from Ocean City, N. J. It is the most common species of the genus in Porto Rico, having been obtained at San Juan, Mayaguez, Ensenada del Boqueron, Isabel Segunda, and Culebra. It is a vigorous fish and sometimes dangerous in its leaps from the water.

Belone raphidoma Ranzani, Nov. Comm. Ac. Nat. Sci. Inst. Bonon., V, 1842, 359, pl. 37, fig. 1, Brazil.
Belone gerania Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 437, 1846, Martinique.
Belone crassa Poey, Memorias, II, 291, 1861, Cuba; Poey, Fauna Puerto-Riqueña, 337, 1881; Stahl, l. c., 79 and 166, 1883.
Belone melanochira Poey, Memorias, II, 294, 1861, Havana.
Tylosurus gladius Bean, Proc. U.S.N.M. 1882, 239 and 430, Pensacola.
Tylosurus raphidoma, Jordan & Evermann, l. c., 715, 1896.

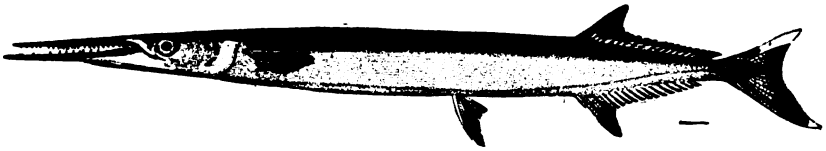

FIG. 17.—*Tylosurus raphidoma.*

Family XXIII. HEMIRAMPHIDÆ. The Balaos.

Body elongate, more or less compressed, covered with large cycloid scales; upper jaw short, lower jaw various, sometimes much produced, the toothed portion at base fitting against the toothed premaxillaries; teeth equal, mostly small and tricuspid; maxillaries anchylosed to premaxillaries. Gillrakers long. Caudal fin rounded, or forked; if forked, the lower lobe the longer. Anal fin modified in the viviparous species (*Zenarchopterus*), unmodified in the others and usually similar to dorsal; no finlets; air-bladder large, sometimes cellular. Third upper pharyngeal on each side much enlarged, solidly united with its fellow to form an oval plate, with slightly convex surface and covered with blunt tricuspid teeth; this is about as large as the united lower pharyngeals and fits into the cavity of the latter; fourth upper pharyngeal wanting or grown fast to third; lower pharyngeal large, thick, triangular, with concave surface. Vertebræ about 50. (Characters verified in *Hemiramphus browni*, *Hyporamphus roberti*, and *Chriodorus atherinoides.*)

Herbivorous fishes of warm seas; mostly shore species; a few pelagic. They feed chiefly on green algæ, and, like the related forms, swim at the surface, occasionally leaping into the air. Size rather small, about a foot in length.

a. Lower jaw bluntish, not at all produced; teeth rather large; the pectorals and ventrals moderate; shore fishes.. CHRIODORUS
aa. Lower jaw acute, longer than upper, or more or less produced; teeth small; species oviparous, anal fin in the male not modified, caudal fin unequally lunate.
  b. Lower jaw produced in a long pointed beak, usually longer than rest of head.
    c. Body moderately compressed; pectoral moderate; shore fishes.
      d. Air-bladder simple; sides of body more or less convex; ventrals inserted anteriorly, far in advance of dorsal.. HYPORHAMPHUS, 34
      dd. Air-bladder cellular; sides of body nearly vertical and parallel; ventrals inserted posteriorly, not far before dorsal.. HEMIRAMPHUS, 35
    cc. Body very slender and compressed, more or less band-like; pectoral fins very long, ventral very short, inserted posteriorly; pelagic species .... EULEPTORHAMPHUS

Genus 34. HYPORHAMPHUS Gill. The Half-beaks.

Body elongate, moderately compressed, sides of body not vertical, but more or less convex; the dorsal outline parallel with that of belly. Upper jaw short; lower jaw prolonged into a slender beak, bordered with membrane; the beak shorter in the young; premaxillaries forming a triangular plate, the teeth of which fit against the toothed portion of mandible; maxillaries joined to premaxillaries. Teeth feeble, mostly tricuspid. Gillrakers rather long. Head covered above with large, shield-like scales. Scales large, deciduous. No finlets; caudal more or less forked, lower lobe the longer; dorsal and anal similar, opposite each other, not modified in male; last ray of dorsal usually short; ventrals small, inserted well forward, nearly midway between opercle and base of caudal. Air-bladder large, simple, not cellular. Young with lower jaw short. Side in our species with a distinct silvery band, as in *Atherina*. Oviparous.

Species numerous in all warm seas, going in large schools, but usually remaining near the shore, feeding chiefly on green algæ.

a. Length of mandible from tip of upper jaw less than rest of head in adult (longer in young); body rather stout; D. 15; A. 16 .... ***unifasciatus***, 51

aa. Length of mandible from tip of upper jaw not less than rest of head, at all ages, much greater in adult; body more slender. D. 14; A. 15........ ***roberti***

51. Hyporhamphus unifasciatus (Ranzani). "*Balaju*"; *Escribano*.

Head 4.6; depth 6.8; eye 4; snout 2.8; maxillary 3.2; mandible 3; interorbital 3.6; **D. 14 or 15;** A. 14 to 16; pectoral 1.6; ventral 3.2; lower lobe of caudal 1.1; scales 52.

Body elongate, not greatly compressed, sides not parallel, back wider than belly; lower jaw produced into a long beak which, from tip of upper jaw, is shorter than rest of head, this character separating the species from *H. roberti*, in which at all ages the mandible from tip of upper jaw is at least as long as head and in adults much longer; dorsal and anal fins completely scaled, the anterior rays produced but not falcate; lower lobe of caudal the longer; lateral line running very low, close to ventral fin, demarcating side from belly.

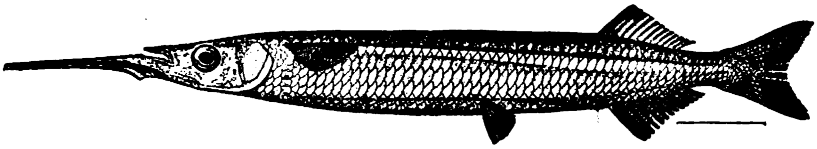

FIG. 18.—*Hyporhamphus unifasciatus.*

Color in life: Back pale-olive or greenish; scales with dark punctulations forming a streak near border; 3 narrow distinct black lines along middle of back from occiput to dorsal fin, the median one faintest; dorsal and anal pale, dusky-tipped; caudal pale, dark-edged; fleshy tip of beak red; a distinct silvery lateral band, about as wide as eye, from upper part of base of pectoral to base of caudal.

The balyhoo is very common in the West Indies, ranging from Key West to Rio de Janeiro, and is considerably used for food; it often leaps from the water and swims in schools, skimming along the surface, 43 examples, 4 to 10½ inches, from San Antonio Bridge, San Juan market, Boqueron, Ponce, Hucares, and Isabel Segunda.

Hemirhamphus unifasciatus Ranzani, Nov. Comm. Ac. Sci. Bonon., V, 1842, 326, Brazil.
? *Hemirhamphus picarti* Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 25, 1846, Algiers.
Hemirhamphus richardi Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 26, 1846, Antilles; Cayenne; Bahia; Rio de Janeiro
Hyporamphus tricuspidatus Gill, Proc. Ac. Nat. Sci. Phila. 1859, 131, Barbados.
Hemirhamphus fasciatus Poey, Memorias, II, 299, 1861, Cuba; not of Bleeker.
Hemirhamphus poeyi Günther, Cat., VI, 262, 1866, Cuba; after Poey.
Hyporhamphus unifasciatus, Jordan & Evermann, l. c., 720, 1896.

Genus 35. HEMIRAMPHUS Cuvier. The Balaos.

Body more robust than in *Hyporhamphus* and different in form, the sides of body being compressed and nearly vertical and parallel. Head and jaws as in *Hyporhamphus*. Dorsal longer than anal fin and inserted farther forward, its last ray more or less produced in American species. Ventral fins small and inserted well backward, much nearer base of caudal than gill-opening. Air-bladder cellular with many partitions (in *H. brouni*). Species probably numerous, but most of them have not been examined as to the characters which separate this genus from *Hyporhamphus*.

a. Upper lobe of pectoral orange in life; length of pectoral scarcely greater than depth of body. D. 14; A. 12; scales 53 .... *brasiliensis*, 52

aa. Upper lobe of caudal dull-bluish in life; scales rather smaller; length of pectoral one-fifth greater than depth of body .... *balao*

52. **Hemirhamphus brasiliensis** (Linnæus). "*Balaju*"; *Balao; Escribano.*

Head 4.2; depth 6.2; eye 3.8; snout 2.9; maxillary 3.6; mandible 3; interorbital 3.9; D. 13 or 14; A. 12 or 13; pectoral 1.5; ventral 3.1; lower lobe of caudal 1.1; scales 53.

Body much elongate, evenly compressed, the sides parallel, so that a cross section of the body is nearly rectangular; mandible produced into a very long beak, longer than head, and ending in a fleshy tip; upper jaw not produced. Lower lobe of caudal the longer.

Color in life: Back uniform dark-greenish, the scales very slightly paler on edges; top of head like back; upper lobe of caudal yellow, lower olivaceous, the inner edge of both lobes dark; green color of the back ceasing abruptly at level of middle of base of caudal and upper edge of base of pectoral; sides and under parts silvery white. The yellow on caudal and the orange on tip of beak are color markings that distinguish it from *Hyporhamphus unifasciatus* or *roberti*.

Very common; edible; its distribution and habits similar to *Hyporhamphus;* 14 specimens, 9 to 14 inches, from San Antonio Bridge, Aguadilla, Mayaguez, Boqueron, and Fajardo; 2 from San Geronimo.

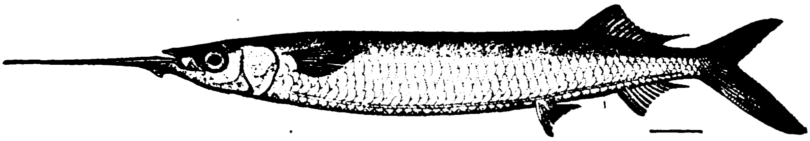

FIG. 19.—*Hemirhamphus brasiliensis.*

Esox maxilla inferiore producta, Browne, Hist. Jamaica, 443, 1756, Jamaica.
Esox brasiliensis Linnæus, Syst. Nat., ed. X, 314, 1758, Jamaica; after Browne.
Hemirhamphus marginatus Le Sueur, Jour. Ac. Nat. Sci. Phila., II, 1823, 135, Lesser Antilles; not of Forskål.
Hemirhamphus brouni Cuvier & Valenciennes, XIX, 13, 1846, Guadaloupe; Martinique.
Hemirhamphus pleii Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 19, 1846, Martinique; Santo Domingo.
Macrognathus brevirostris Gronow, Cat., 148, 1854, Jamaica; after Browne.
Hemirhamphus filamentosus Poey, Mem., II, 297, 1861, Cuba; Poey, Fauna Puerto-Riqueña, 337, 1881; Stahl, l. c., 166, 1883.
Hemirhamphus brasiliensis, Jordan & Evermann, l. c., 722, 1896.

Family XXIV. EXOCŒTIDÆ. The Flying-fishes.

Body oblong or elongate, covered with cycloid scales, which are rather deciduous. Lateral line running very low, along side of belly. Head more or less scaly, with vertical sides. Mouth moderate, terminal, the jaws not prolonged into a beak. Premaxillaries not protractile, hinged at base mesially; margin of upper jaw chiefly formed by premaxillaries, the short maxillaries entering the lateral margin; maxillary free from premaxillary, its edge slipping under front of preorbital. Dentition various, teeth small and weak. Dorsal fin without spines, inserted on posterior part of body, opposite anal and more or less similar to it; ventrals abdominal, of several soft rays, inserted posteriorly; pectoral fin inserted high, used as an organ of flight; shoulder-girdle and pectoral muscles very strong; caudal fin forked, lower lobe the longer. No finlets. Vent close in front of the anal. Nostrils large, double, near eye. Lower pharyngeals enlarged and fully united, forming a large, transversely concave plate, covered with large, close-set, blunt, tricuspid teeth; third upper pharyngeal greatly enlarged, not united with its fellow, both covered with large, blunt, tricuspid teeth; fourth superior pharyngeal wanting in adult (probably coossified with the third); (these characters verified on *Exocœtus californicus*); vertebræ without zygapophyses. Gill-membranes not united, free from isthmus. Pseudobranchiæ hidden, glandular. Gillrakers various. Gills 4, a slit behind fourth. Air-bladder very large, not cellular, so far as known, and extending far backward among hæmapophyses of the caudal vertebræ. Vertebræ about 50. Intestinal canal simple, without cæca.

Carnivorous or herbivorous fishes; 4 genera and about 65 species, abounding in all warm seas, mostly pelagic, swimming near the surface, and skipping or sailing through the air, sometimes for considerable distances.

a. Roof of mouth (vomer, palatines, pterygoids) and tongue provided with teeth; body not angular in outline (elliptical in cross section); pectoral fins moderate, not reaching beyond middle of dorsal fin, ventrals rather long, inserted behind middle of body; dorsal fin elevated; anal long, its base scarcely shorter than that of dorsal. PAREXOCŒTUS, 36

aa. Roof of mouth and tongue with fewer teeth or none (vomer and palatines toothed or not); body angular in outline (a cross section subquadrate); pectoral fins very long, their tips usually reaching nearly to base of caudal; lower jaw little prominent; snout short.

b. Ventral fins inserted anteriorly, much nearer tip of snout than base of caudal, not used as organs of flight, their tips not reaching nearly to front of dorsal; anal fin long, its base nearly equal to that of dorsal..... EXOCŒTUS

bb. Ventral fins inserted posteriorly, usually nearer base of caudal than tip of snout, used as organs of flight, their tips reaching past middle of base of anal.

c. Anal fin long, its base a little less than that of dorsal, its origin nearly opposite that of dorsal......... EXONAUTES

cc. Anal fin short, its base one-half to two-thirds that of dorsal, its origin behind that of dorsal....... CYPSILURUS, 37

Genus 36. PAREXOCŒTUS Bleeker.

Body moderately elongate, elliptical in cross section. Snout short; lower jaw not produced. Roof of mouth (vomer, palatines, and pterygoids) fully provided with teeth; pectoral fins moderate, not reaching beyond middle of dorsal; ventrals long, inserted behind middle of body; anal fin about as long as dorsal; dorsal high.

Small flying-fishes of tropical coasts, widely distributed.

53. Parexocœtus mesogaster (Bloch). *Volador; Flying-fish.*

Head 4.4 in length of body; depth 5; D. 12; A. 13; about 38 scales in lateral line, 5 rows of scales between lateral line and dorsal fin. Body elongate, compressed (not angulated), rather deep; width of body at base of pectorals 2 in head; head narrow, compressed, almost trenchant below; interorbital area flattish, about as wide as eye, 3 in head. Snout short, rather pointed, its length 4.25 in head; teeth on tongue and palatines; gillrakers numerous, long and slender; pectoral fins of moderate length, their length 1.66 to 2 in length of body, their tips reaching middle of base of dorsal fin; second ray of pectoral divided; dorsal fin very high, its longest rays about 0.16 longer than head; base of dorsal about 1.14 in length of head; tips of anterior rays of dorsal reaching beyond tips of posterior rays when fin is deflexed, almost to base of caudal fin; ventrals rather short, 4.75 in length of body, their tips reaching slightly past origin of anal fin; origin of ventrals midway between pupil and last caudal vertebra; anal fin opposite dorsal; lower lobe of caudal rather short, slightly longer than head.

Color, blue above, silvery below, pectoral (dusky in the young) becoming nearly white in the adult; color of ventrals very similar to pectoral, the duskiness in the young formed of fine blackish dots; upper half of anterior rays of dorsal fin black; anal fin with few small black dots, more numerous in the young; caudal dusky-reddish.

This species reaches a length of 7 inches. It is common in the tropical seas of both the East Indies and West Indies, and in the Hawaiian Islands. It ranges north in the Gulf Stream to Rhode Island and is the most common flying-fish of the Carolina region. The young often has one or two fleshy barbels on the tip of the lower jaw, these being fragile and easily destroyed.

During the voyage of the *Fish Hawk* to Porto Rico and return to Norfolk, flying-fish were seen nearly every day and were particularly abundant between Savannah and the Bahamas, in the Windward and Mona passages, and along the north coasts of Cuba, Santo Domingo, and Porto Rico. Scarcely a day passed when schools of twenty to a hundred or more did not follow along abreast of the ship. They were more numerous on bright days when there was considerable wind and the sea was somewhat rough. Apparently two or more species were seen, though the vast majority probably belonged to this species which seems to come nearer to shore than any other. A specimen 5.5 inches long flew aboard the ship at Aguadilla January 18.

Exocœtus mesogaster Bloch, Ichthyolgia, pl. 399, 1795, Martinique; on a poor drawing by Plumier.
Exocœtus orbignianus Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 131, 1846, Montevideo, based on a drawing.
Exocœtus hillianus Gosse, Nat. Sojourn in Jamaica, II, pl. 1, fig. 1, 1851, Jamaica.
Exocœtus gryllus Klunzinger, Fische des Rothen Meeres, 586 1870, Red Sea.
Parexocœtus mesogaster Jordan & Evermann l. c., 728, 1896.

Genus 37. CYPSILURUS Swainson.

Body elongate, broad above, somewhat compressed; head short, blunt, narrowed below; mouth small; jaws very short, about equal; chin without barbel; maxillaries not joined to premaxillaries; teeth very feeble or wanting; eyes large; gillrakers moderate; scales large, deciduous; no finlets; dorsal fin short, opposite anal; caudal widely forked, lower lobe the longer; pectoral fins very long, reaching past beginning of anal and serving as organs of flight, their great size enabling these fishes to sustain themselves in the air for some time; ventral fins large, posteriorly inserted, also used as organs of flight; air-bladder very large; no pyloric cæca.

Species numerous, in all warm seas, living mostly in the open water and swimming in large schools; largely cosmopolitan, and any of the forms may be expected to be found within our limits.

a. Second ray of pectoral divided (first simple); third and fourth rays longest.
b. Ventral fins inserted about midway between pupil and last caudal vertebra.
c. Dorsal and anal fins without black markings; ventrals pale.
d. Base of anal 1.66 in base of dorsal; pectoral 1.44 in length, reaching last ray of dorsal; ventrals 2.75 in body, reaching last ray of anal .... *heterurus*
dd. Base of anal 2 in base of dorsal; pectoral 1.40 in length of body, the tip reaching end of dorsal fin; length of ventrals 2.89 in body, their tips nearly reaching last ray of anal.. *lutkeni*
cc. Dorsal and anal fins marked with black; dorsal with one or more dark blotches; anal with a black spot on tips of third to sixth rays; ventrals black, with pale edgings and a white spot near base....................... *furcatus*
bb. Ventral fin inserted midway between posterior margin of preopercle and last caudal vertebra.
e. Pectoral with posterior half rather abruptly black; anal white .... *nigricans*
ee. Pectoral unicolor or nearly so, not abruptly black posteriorly.
f. Dorsal fin slightly dusky, but without distinct markings; other fins faintly shaded, but without distinct black markings; pectoral reaching base of last anal ray; ventrals almost as far. D. 13; A. 10.................. *lineatus*
ff. Dorsal fin with a round, black blotch as large as eye on tips of middle rays; other fins all pale; pectoral reaching beyond tips of dorsal and anal. D. 12; A. 11.. *cyanopterus*
bbb. Ventral fins inserted at a point midway between middle of opercle and last caudal vertebra (or between tip of snout and tip of upper lobe of caudal).. *bahiensis*, 54
aa. Second ray of pectoral simple (like the first); third ray divided.
j Snout more obtusely descending than in any other species, its length 4.5 in head.......................... *gibbifrons*

54. Cypsilurus bahiensis (Ranzani). *Volador.*

Head 4; depth 5; eye 3.1; snout 4.25; interobital 3; D. 13; A. 9; scales about 50.

Body quadrate, stout, its width about two-thirds its depth; mouth small, snout short; eye large; top of head flat; pectoral very long, reaching last rays of dorsal and anal, second ray divided, third and fourth longest; ventrals long, longer than head, reaching nearly as far as tip of pectoral, their origin midway between last caudal vertebra and middle of opercle; dorsal considerably in front of anal, its base nearly double that of anal; caudal widely forked, lower lobe the longer.

Color, bluish, silvery above, silvery on sides, white below; side of head silvery; pectoral nearly uniform dusky, paler at base, and bluish-silvery outside; ventrals and anal pale; dorsal pale; caudal somewhat dusky.

Found in tropical seas, north to Cuba, and said to be one of the commonest species; reaches a length of 8 inches. One specimen flew aboard the ship off Mayaguez, January 20.

Exocœtus bahiensis Ranzani, Nov. Comm. Ac. Sci. Inst. Bonon., V, 1842, 362, pl. 38, Bahia.
Exocœtus vermiculatus Poey, Memorias, II, 300, 1861, Cuba.
Exocœtus spilonopterus Bleeker, "Nederl. Tydschr. Dierk., III, 1863, 113," Sumatra.
? *Exocœtus parræ* Poey, Synopsis, 385, 1868, Cuba; description insufficient; taken from an old drawing.
Exocœtus bahiensis, Jordan & Evermann, l. c., 739, 1896.
Cypsilurus bahiensis, Jordan & Evermann, l. c., 2836, 1898.

Family XXV. AULOSTOMIDÆ. The Trumpet-fishes.

Body compressed, elongate, covered with small ctenoid scales. Lateral line continuous. Head long; mouth small, at end of a long, compressed tube. Lower jaw prominent, with a barbel at symphysis. Premaxillaries feeble, not protractile; maxillary broad, triangular, with a supplemental bone. Teeth minute, in bands on lower jaw and vomer. Branchiostegals 4; gills 4, a slit behind fourth. Pseudobranchiæ well developed. Gillrakers obsolete. Gill-membranes separate, free from isthmus. Air-bladder large. Spinous dorsal present, of 8 to 12 very slender free spines; the soft dorsal and anal rather long, similar, posterior, with 23 to 28 rays each; caudal small, rhombic, the middle rays longest but not produced into a filament; ventrals abdominal, of 6 rays, all articulated; pectorals broad, rounded, the space in front of them scaly. First four vertebrae elongated. Two pyloric cæca.

A single genus with two species, found in tropical seas.

Genus 38. AULOSTOMUS Lacépède.

Characters of this genus included with those of the family.

a. Base of soft dorsal and anal not black; each fin with a black band parallel with its base.

b. Eye 2 to 2.5 in postorbital part of head; ground-color reddish; silvery lateral streaks, not all below lateral line. *maculatus*, 55

bb. Eye 3.5 in postorbital part of head; ground-color brown; lateral silvery streaks all below lateral line...... *cinereus*

55. Aulostomus maculatus Valenciennes. *Trumpet-fish; "Trompetero."*

Head 3; eye 2 to 2.5 in postorbital part of head; D. x–23; A. 25; V. 6. Lower jaw prominent, keeled, with a small barbel at symphysis; premaxillary slender, maxillary broad; triangular patches of minute teeth on lower jaw, vomer, palatines, gill-arches, and pharyngeals. Intestinal canal short; two pyloric cæca.

Color, olivaceous, with one or two series of brown or blue dots along each side of the back; another irregular series from the preoperculum along each side of the belly to anal fin; three or four silvery lines on each side of abdomen, replaced on head by irregular oblique streaks; anterior part of dorsal and anal with a horizontal black band, parallel with base of fin but remote from it; caudal fin with usually two round black spots; ventral fins plain, spotted. (Günther.)

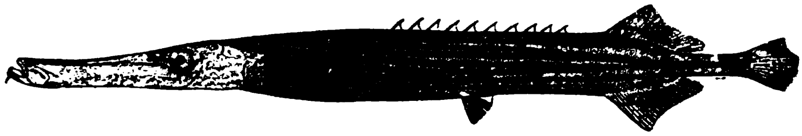

FIG. 20.—*Aulostomus maculatus.*

Found in the Caribbean Sea, north to southern Florida; rather common southward; apparently not common about Porto Rico, as only one small specimen was obtained. This was seined in Boqueron Bay January 26.

Aulostoma maculatum Valenciennes, in Cuvier's Illst. Poissons, pl. 92, fig. 2, about 1845.
Aulostoma coloratum Müller & Troschel, in Schomburgk's Hist. Barbados, 673, 1848, Barbados.
Aulostomus maculatus, Jordan & Evermann, l. c., 754, 1896.

Family XXVI. FISTULARIIDÆ. The Cornet-fishes.

Body extremely elongate, much depressed, broader than deep. Scaleless, but having bony plates present on various parts of body, mostly covered by skin. Head very long, anterior bones of skull much produced, forming a long tube, which terminates in the narrow mouth; this tube formed by symplectic, proethmoid, metapterygoid, mesopterygoid, quadrate, palatines, vomer, and mesethmoid. Both jaws, and usually vomer and palatines also, with minute teeth; membrane uniting bones of tube below very lax, so that tube is capable of much dilation. Post-temporal coossified with the cranium. Branchiostegals 5 to 7; gills 4, a slit behind fourth. Gill-membranes separate, free from isthmus. Gillrakers obsolete. Basibranchial elements wanting. Pseudobranchiæ present. Air-bladder large. Spinous dorsal entirely absent; soft dorsal short, posterior, somewhat elevated; anal fin opposite it and similar; caudal fin forked, middle rays produced into a long filament; pectoral small, with a broad base, preceded by a smooth area as in the *Gasterosteidæ;* pectoral ossicles 3; interclavicles greatly lengthened; supraclavicles very small; ventral fins very small, wide apart, abdominal (through partial atrophy of the girdle, by which they lose connection with the interclavicles), far in advance of the dorsal, composed of 6 soft rays. Pyloric cæca few; intestine short. Vertebræ very numerous (4 — 44 to 49 + 28 to 33), the first four very long.

Fishes of tropical seas, related to the sticklebacks in structure, but with prolonged snout and different ventral fins. A single genus, with three species.

Genus 39. FISTULARIA Linnæus. Trumpet-fishes.

Characters of the genus included above with those of the family.

a. Upper lateral edges of snout with few serrations or none; body with blue spots........................ *tabacaria*, 56
aa. Upper lateral edges of snout sharply serrated; body with few blue spots or none.............................. *petimba*

56. Fistularia tabacaria (Linnæus). *Trumpet-fish; Trompetero.*

Head 2.8; mandible about 4 in snout; snout 3.75 in length of body. D. 14; A. 13. Mouth slightly oblique, lower jaw the longer, overlapping upper; snout much prolonged, tapering but little forward, its edges with fine serrations or none. Margin of orbit with sharp compressed points in front and behind. Reddish-brown above, variegated with numerous large, unequal, oblong, pale-blue spots on sides and back, arranged in series.

West Indies and the neighboring seas, generally common; occasional northward to Carolina and Florida, or even to Massachusetts. Reaches a length of 6 feet. One specimen obtained by Mr. Gray at San Geronimo; reported from Porto Rico by Poey and Stahl.

Petimbuaba, Marcgrave, Hist. Brazil, 148, 1648, Brasil.
Fistularia tabacaria Linnæus, Syst. Nat., X, 312, 1758, America; Jordan & Evermann, l. c., 757, 1896.
Fistularia neoboracensis Mitchill, Trans. Lit. and Phil. Soc., I, 1815, 437, New York.
Aulostome marcgravii Castelnau, Anim. Nouv. Amér. Sud, 30, 1850, Bahia; Rio Janeiro.
Flagellaria fistularis Gronow, Cat. Fishes, ed. Gray, 146, 1854, American Ocean.
Solenostomus serratus, Poey, Fauna Puerto-Riqueña, 337, 1881.
Solenostomus tabacarius, Stahl, l. c., 79 and 165, 1883.

Family XXVII. SYNGNATHIDÆ. The Pipe-fishes.

Body elongate, usually slender, covered with bony plates which are firmly connected, forming a bony carapace. Head slender, snout long, tube-like, bearing short toothless jaws at end. Gill-openings reduced to a small aperture behind the upper part of the opercle. Tail long, prehensile or not, usually provided with a small caudal fin. Male fishes with an egg pouch, usually placed on under side of tail, sometimes on abdomen, commonly formed of two folds of skin which meet on median line. The eggs are received into this pouch and retained until some time after hatching, when the pouch opens, permitting the young to escape. Dorsal fin single, nearly median, of soft rays only; pectorals small, or wanting; ventrals none; anal fin minute, usually present.

a. Tail not prehensile, usually with a caudal fin; axis of head usually in line with axis of body.
b. Top of head with a slight carination, or none.
SYNGNATHINÆ;
c. Pectoral fins present; caudal present.
d. Male with egg pouch under tail, formed by lateral membranes which become connected along middle, forming a closed pouch.
e. Dorsal fin inserted over or just before vent.. SIPHOSTOMA, 40
dd. Male with egg pouch on abdomen; ridges of body prominent and distinct; caudal fin moderate... DORYRHAMPHUS
cc. Pectoral fins wanting; caudal wanting or rudimentary; male with ova attached to abdomen, without closed pouch; no adipose fin.
f. Back without peculiar tube.. SYNGNATHUS
ff. Back with a peculiar tube inclosed by the scutes, and extending for a distance before dorsal fin...... OSPHYOLAX
bb. Top of head strongly carinated.. CORYTHROICHTHYS, 41
HIPPOCAMPINÆ:
aa. Tail prehensile; caudal fin small; head shaped like that of a horse, placed at a large angle with axis of body; egg pouch at base of tail.
g. Body compressed; occiput with a narrow bony crest, surmounted by a coronet; shields with tubercles or spines. HIPPOCAMPUS, 42

Genus 40. SIPHOSTOMA Rafinesque. The Pipe-fishes.

Body elongate, very slender, 6 or 7-angled, not compressed, tapering into a very long tail; dorsal keels of the trunk not continuous with those of tail. Head slender, tapering into a long, tube-like subterete snout, which bears the very short, toothless jaws at end. Humeral bones firmly united with "breast ring." Body covered with a series of bony, keeled, radiated plates, arranged in linear series. Dorsal fin distinct, rather short, inserted before or opposite the vent, which is near middle of body; caudal fin present, rather small; anal fin minute, close behind vent; pectorals developed, short and rather broad. Male fishes with an egg pouch along under side of tail, formed by two cutaneous folds, and splitting lengthwise to release the young fishes.

Species very numerous, inhabiting all warm seas; abounding in bays among the seaweeds and entering rivers. The females in most species are deeper than the males, with more robust trunk, longer snout, and a more distinct ventral keel.

a. Top of head with a slight carination or none; snout keeled or not: opercle without prominent ridge; base of dorsal not elevated.
b. Dorsal moderate or long, its first ray in advance of vent; snout moderate or long; angles of body generally prominent.
c. Dorsal covering 1 or 2 body rings.
d. Dorsal covering about 6 or 7 caudal rings, rarely fewer.
e. Caudal rings 36 to 41.......... *fistulatum*
ee. Caudal rings 31 to 34.
f. Dorsal 29 to 32, on 2+6 rings .... *mackayi*, 57
ff. Dorsal 27, on 1+7 rings, rarely on 2+6.......... *floridæ*, 58
eee. Caudal rings 24; body rings 19; dorsal rays 30, on 1+6 rings; snout long; body slender.......... *poeyi*
dd. Dorsal covering 4 or 5 caudal rings.
g. Dorsal rays 21 to 32.
h. Dorsal rays 29 to 32, on 1 + 9 rings; rings 17 + 35; snout 2 in head, head with keel .... *pelagicum*
hh. Dorsal rays 26 to 28, on 1.5 + 5 rings; rings 16 + 34; snout short, 2 in head; head with slight keel .... *rousseau*
hhh. Dorsal rays 23 to 25, on about 1 + 4 rings; rings usually 16 + 33; snout short, 2 in head .... *elucens*, 59
gg. Dorsal very short, 18 rays, on 1 + 5 rings; rings 17 + 32; snout short .... *jonesi*, 60
ddd. Dorsal very short, covering 3 caudal rings and 1.5 body rings, its rays 20 to 23; rings 17 + 27; snout very short; head keeled above.......... *brachycephalum*
cc. Dorsal covering 3 body and 4 to 6 caudal rings.
i. Rings 16 to 18 + 29 to 33.
j. Snout rather short, not half length of head; dorsal fin very high; rings 18 + 33; dorsal 35, on 5 + 4 rings; belly in female with a black keel; sides with narrow vertical silvery streaks; dorsal spotted.......... *affine*
jj. Snout rather long, more than half head.
ii. Rings 20 to 21 + 36 to 38; dorsal 32 to 37, on 3 + 5 rings; belly flat or slightly concave; snout moderate.... *louisianæ*
iii. Rings 16 to 20 + 36 to 40; dorsal 36 to 40, on 5 + 4 or 4 + 5 rings.......... *fuscum*
bb. Dorsal fin very short, its first ray not in advance of vent; rings 15 + 37 to 39; snout very short, less than two-fifths head; angles of body little marked, the form subterete.......... *crinigerum*

57. **Siphostoma mackayi** Swain & Meek.

Head 5.66 to 6.25 in total length. D. 29 to 32; rings 18 + 33 to 36. Snout compressed, 1.75 to 2 in head, its median line with a slight keel above and below, with smaller keels on each side; opercle not keeled. Dorsal somewhat higher than width of a body ring, its base about 1.33 in length of head, covering 2 + 6 rings. Pectoral higher than length of base; tail about 1.83 in total length of fish; body deep, its greatest depth in adult females equaling width of four body rings.

Color in spirits: Grayish or dark olive; males with about 14 dark-gray crossbars on side, broader than interspaces; body usually more or less spotted with small white spots; dorsal pale, usually dotted over with darker; caudal dusky, generally spotted with white; opercle usually with white bars.

Gulf of Mexico and West Indies; known from the Snapper Banks off Pensacola, Key West, and Cozumel, Yucatan; rather common. One specimen, a female, 7 inches long, taken at Mayaguez, January 19.

Siphostoma mackayi Swain & Meek, Proc. U. S. N. M. 1884, 239, Key West; Jordan & Evermann, l. c., 766, 1896.

58. **Siphostoma floridæ** Jordan & Gilbert.

Head 6 to 6.5 in total length. D. 27; rings 17 to 18 + 31 to 32. Snout rather short, about 1.66 in head; median line well keeled above and below, the ridge on both sides of median ridges above and below not so conspicuous. Occiput and opercle little keeled. Dorsal shorter than head, covering 1 + 6 to 7 rings, its height 5 times in base; caudal fin 2.5 in base of dorsal; pectoral slightly higher than length of base; tail longer than trunk, 1.83 in total length, caudal pouch covering about 18 rings.

Color in life: Dark green; side with gray specks and without dark band; tail with faint darker bars, broader than interspaces; sides of tail especially mesially, with many rough and oblong pale spots; snout mottled, especially on side; lower part of the opercle nearly plain; dorsal translucent, yellowish at base; caudal yellow, dusky at tip; anal plain.

Found on sandy shores from North Carolina to Texas (Beaufort, N. C., Corpus Christi, Tex.); rather common. Three specimens seined in Ensenada del Boqueron, January 26.

Siphostoma floridæ Jordan & Gilbert, Proc. U. S. N. M. 1882, 263, Pensacola, Fla.; Jordan & Evermann, l. c., 766, 1896.

59. **Siphostoma elucens** (Poey).

Head 7 in total length; depth 3.6 in head; snout 1.9 in head; body rings 17; caudal rings 32. D. 23, on 1 + 4 rings. Body rather stout; snout moderate; keels rather strong; pouch of male covering about 17 rings.

Color grayish-brown, back and sides more or less mottled with lighter and darker; lower half of snout with alternate bars of white and brown.

Known only from Havana and Porto Rico; one specimen, a male, 6 inches long, with pouch filled with eggs, obtained at San Antonio Bridge, January 12.

Syngnathus elucens Poey, Synopsis, 443, 1867, Havana.
? *Syngnathus flavirostris* Poey, Enumeratio, 178, 1875, Havana.
? *Syngnathus picturatus* Poey, Enumeratio, 178, 1875, Havana.
? *Syngnathus linea* Poey, Enumeratio, 178, 1875, Havana.
? *Syngnathus marmoreus* Poey, Enumeratio, 178, 1875, Havana.
? *Syngnathus ascendens* Poey, Enumeratio, 179, 1875, Havana.
Siphostoma elucens, Jordan & Evermann, l. c., 768, 1896.

60. **Siphostoma jonesi** (Günther).

Rings 17 + 32. Dorsal 18, on 1 + 5 rings. Head and snout short, the latter somewhat bent upward, shorter than the postorbital portion of the head, keeled above, but without spines in the median line. Interorbital space concave, crown and occiput with a median keel. Keels of body sharp but not spiny; lateral keel of the trunk passing into lower keel of tail; a ridge running across opercle but not reaching its end; tail twice as long as trunk without head; caudal very short.

Color: Blackish-brown; upper half of trunk with 3, upper half of tail with 7, equidistant white crossbands.

Bermudas and Porto Rico. Two small males, 2.75 and 3.50 inches long, respectively, dredged at station 6085, between Vieques and Culebra islands, in 14 fathoms, February 6. The larger has the pouch well filled with eggs and the other has a few eggs.

Syngnathus jonesi Günther, Ann. Mag. Nat. Hist., series 4, XIV, 8, 1874, Bermudas.
Siphostoma jonesi, Jordan & Evermann, l. c., 768, 1896.

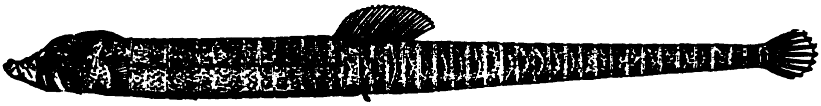

FIG. 21.—*Corythroichthys cayorum.*

Genus 41. CORYTHROICHTHYS Kaup.

This genus differs from *Siphostoma* in the strong keel on top of head, the strong opercular ridges, the short, stout body with prominent angles, and the very short snout. Three species known.

a. Top of head strongly carinated, keel usually extending from interorbital space to first body ring; body stout, usually with sharp angles and variegated coloration; head in line with axis of body; opercle with a prominent ridge.
  b. Caudal rings about 30; dorsal rays 23 to 27, snout short.
    c. Rings 18 + 30; dorsal rays 23, on 1 + 4 rings; snout 2.4 in head, its color white; body with 12 irregular brown crossbands, and white markings .... *albirostre*
  bb. Caudal rings 25, body rings 20; dorsal rays 40, on 3 + 7 rings; snout long, more than half head; form of body undescribed .... *cayennense*
  bbb. Caudal rings 26, body rings 17; dorsal rays 21, on 1.5 + 3.5 rings; snout very short, 3.2 in head .... *cayorum*, 61

61. **Corythroichthys cayorum** Evermann & Kendall.

Head 8.6; depth 12.6; snout 3.2 in head; eye 4.33; D. 21 rays, on 1.5 + 3.5 rings; A. 3, on first caudal ring; C. 10; P. 10. Rings 17 + 26 = 43. Body short and stout; head short, snout very short; tail but little longer than head and trunk. Cranial ridges strong; a high, sharp keel on snout; occipital keel very high, its edges convex, notched near middle, not continuous with keel on snout; a strong supraocular ridge, beginning opposite posterior end of nasal keel and continuing backward, with one hiatus upon upper edge of opercle; just below this on opercle another longer but scarcely stronger ridge;

another short ridge on anterior part of opercle at level of lower part of eye; opercles very convex, as if swollen outward; keels on body and tail all strong, the two lateral keels on body terminating on third caudal ring; the two lateral keels on tail beginning on last body ring, thus overlapping body keels; median keel on side well developed, terminating on sixteenth body ring; ventral keels strong; abdominal keel very strong. Egg-sac on first 18 caudal rings.

Color, yellowish-brown, with darker punctulations; tip of snout white; cheek, throat, and under parts of snout white, crossed by about 7 or 8 irregular brownish bars extending downward and backward; opercles brown; fins pale.

This species is related to *C. albirostre*, of Heckel, differing from it chiefly in the shorter snout, smaller dorsal, and fewer rings. It is known only from Key West and Porto Rico. A fine female, 4 inches long, was seined on Cayo Jancudo, at Fajardo, February 17.

Corythroichthys cayorum Evermann & Kendall, Bull. U. S. F. C. 1897 (Feb. 7, 1898), 128, pl. 7, fig. 7, near Crawfish Bar, Key West, Fla.; Jordan & Evermann, l. c., 2888, 1898.

Genus 42. HIPPOCAMPUS Rafinesque. The Sea-horses.

Body strongly compressed, belly gibbous, tapering abruptly to a long, quadrangular, prehensile tail. Head with a distinct curved neck placed nearly at a right angle with direction of the body, surmounted by a compressed occipital crest, on top of which is an angular, star-shaped coronet; top and sides of head with spines. Physiognomy remarkably horse-like, like that of a conventional "knight" at chess. Body and tail covered with bony plates, forming rings, those on body each with 6 spines or tubercles, those of tail with 4. Pectoral fins present, short and broad; anal minute, usually present; dorsal fin moderate, opposite the vent. Egg-pouch in male a sac at base of tail, terminating near vent.

Species numerous in all warm seas. They attach themselves by their tails to seaweed and other floating substances, and are often carried to great distances by currents.

a. Dorsal fin large, with 19 rays; rings 11 + 32 to 35; depth of body equals length of head; snout 2.33 in head; dorsal fin on 3.5 + 0 rings; body mottled, not dotted .... *hudsonius*
aa. Dorsal fin smaller, with 16 to 18 rays.
  b. Dorsal fin with 17 or 18 rays, on 1 caudal ring; snout short, less than half length of head; light-blue spots on head and snout; head usually without filaments; size large .... *punctulatus*, 62
  bb. Dorsal fin with 16 rays, on 4 + 0 rings; rings 12 + 31; snout longer than postocular distance; body unspotted; size moderate .... *stylifer*
aaa. Dorsal fin very small, with 12 rays, on 2 + 1 rings; rings 11 + 30; snout very short; body without white spots.. *zosteræ*

62. Hippocampus punctulatus Guichenot. *Sea-horse; Cabalito de Mar.*

D. 18, covering 2½ + 1 rings; rings 12 + 30. Snout short, about 2.6 in head, or slightly shorter than postorbital part of head; eye 2 in snout; supraorbital spines divergent, each with a minute spine in front; coronet high, about 1.5 in snout; no filament on coronet, and only a few very short ones anywhere on head, none on body; spines of body strong, but blunt.

Color, dark-brown, fins pale; head with numerous minute white specks; body and tail with a few similar specks.

Found in the tropical parts of the Atlantic; common in the West Indies, Brazil, and western Africa, reaching occasionally northward in the Gulf Stream as far as Beaufort, N. C. (Jenkins.) One specimen, about 3 inches long, seined at Ponce, January 30.

Hippocampus punctulatus Guichenot, in Sagra's Cuba, Poiss., 174, pl. 5, fig. 2, 1860, Cuba; Poey, Fauna Puerto-Riqueña 347, 1881; Stahl, l. c., 79 and 165, 1883; Jordan & Evermann, l. c., 777, 1896.
Hippocampus marginalis Heckel, in Kaup's Lophobr., 15, 1856, Mexico.
Hippocampus fascicularis Heckel, in Kaup's Lophobr., 15, 1856, Mexico.
Hippocampus longirostris Heckel, in Kaup's Lophobr., 12, 1856; not of Cuvier.
Hippocampus guttulatus Günther, Cat., VIII, 202, 1870; probably not of Cuvier.
? *Hippocampus kuda* Bleeker, Nat. Tyds. Ned. Ind., III, 82, East Indies.

Family XXVIII. ATHERINIDÆ. The Silversides.

Body rather elongate, somewhat covered with scales of moderate or small size, which are usually, but not always, cycloid. No lateral line; some scales often with rudimentary mucous tubes. Cleft of the mouth moderate. Teeth small, on jaws and sometimes on vomer and palatines, rarely wanting. Premaxillaries protractile or not. Opercular bones without spines or serrature. Gill-openings wide, the gill-membranes not connected, free from isthmus; gills 4, a slit behind fourth. Pseudobranchiæ present; gillrakers usually long and slender. Branchiostegals 5 or 6. Dorsal fins 2, well separated, the first of 3 to 8 slender flexible spines, second of soft rays; anal with a weak spine similar to soft dorsal, but usually larger; ventral fins small, abdominal, not far back, 1 small spine and 5 soft rays; pectorals moderate, inserted high. Air-bladder present. No pyloric cæca. Vertebræ numerous, usually about 23 + 23 = 46; third and fourth superior pharyngeals coossified, with teeth.

This family comprises about 15 genera and 60 species of carnivorous fishes, mostly of small size, living in great schools near shore in temperate and tropical seas; a few species in fresh water; all the species have a silvery band along side; this is sometimes underlaid by black pigment. All which are large enough are highly valued as food; hence the common name of "fishes of the king" (pescados del rey, or pesce re, or peixe rey).

a. **Premaxillary narrow posteriorly, its edge nearly straight. Body little compressed, belly rounded; pectorals short; scales cycloid; vomer with teeth; first dorsal with 5 to 9 spines, inserted in front of the rather short anal; mouth short .... ATHERINA, 4**
aa. **Premaxillary broad posteriorly, its edge strongly curved.**
b. **Lower jaw strong, projecting beyond upper.**
c. **Scales small, rough, in 70 series; teeth well developed; vomer usually with a few teeth; jaws long.... LETHOSTOLE**
cc. **Scales large, smooth, in 38 to 50 series.......... CHIROSTOMA**
bb. **Lower jaw moderate, its tip included; vomer without teeth.**
d. **Scales laciniate; dorsal and anal scaly .... KIRTLANDIA**
dd. **Scales cycloid; soft dorsal and anal mostly without scales.......... MENIDIA**

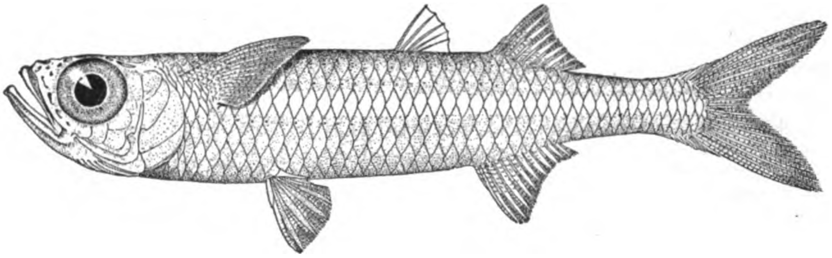

FIG. 22.—*Atherina stipes.*

Genus 43. ATHERINA (Artedi) Linnæus.

Body oblong, compressed. Mouth large, terminal, oblique; jaws about equal, their edges nearly straight; maxillary extending to front of eye. Premaxillaries narrow posteriorly, strongly protractile. Villiform teeth in bands on jaws, vomer, and palatines. Species numerous, mostly European.

a. **Anal fin rather short, of 10 to 16 rays.**
b. **Scales large, 36 to 40; first dorsal with 5 or 6 spines.**
c. **Head very broad, interorbital width about equal to the large eye, which is about 2.33 in head. Scales 36 to 41.**
d. **Anal rays I, 12, or I, 13; head about 4 in length .... *stipes*, 63**
dd. **Anal rays I, 10 or 11; head 3.5 to 3.66 in length .... *laticeps*, 64**
cc. **Head narrow and pointed, the large eye much greater than interorbital width; body slender and weak, depth 6 in length; anal I, 12; scales 38 to 41 .... *aræa*, 65**
bb. **Scales small, 45 to 52; body very slender; first dorsal long, with 7 or 8 spines.**
e. **Anal rays I, 11; eye 3 in head; scales 45 .... *harringtonensis***
ee. **Anal rays I, 15; eye 2.5 in head; scales 52.......... *carolina***
aa. **Anal fin longer, of about 20 rays; dorsal rays V-I, 15 .... *microps***

63. Atherina stipes (Müller & Troschel).

Head 4; depth 5.3; eye 2.5; snout 4; maxillary 2.7; mandible 2.3; interorbital 3; D. V-I, 9; A. I, 12 or 13; pectoral 1.6; ventral 2.3; caudal 1.2; scales 41.

Close to *A. laticeps*, but with top of head narrower and more pointed, eye smaller, lateral band much wider, about 4.5 in head, equal to length of snout. Known only from the Barbados and Porto Rico; apparently rare, only two specimens collected, about 2.5 inches long, these being taken with the abundant *A. laticeps* at Culebra.

Atherina stipes **Müller & Troschel, in Schomburgk, Hist. Barb., 671, 1848, Barbados; Jordan & Evermann, l. c., 790, 1896.**

64. **Atherina laticeps** Poey. *Cabezote.*

Head 3.5; depth 4.8; eye 2.3; snout 4; maxillary 2.1; mandible 2; interorbital 2.4; D. v–I, 9; A. I, 10 or 11; pectoral 1.5; ventral 2; caudal 1.2; scales 38. Body elongate, somewhat compressed, especially posteriorly, very heavy forward; head very large, flat above, interorbital space very broad, equal to eye, which is very large; snout very short, wide and blunt; mouth wide, very oblique; maxillary narrow, reaching beyond front of eye; lower jaw the shorter; jaws, vomer, and palatines with villiform bands of very short teeth; spinous dorsal of extremely slender flexible spines; scales large, with a glazed or enamel-like appearance, as if highly polished, in alcoholic specimens when dry.

Color in life: Translucent green, silvery below with a well-defined silvery lateral band, below which is a series of dots along side; back with dark dots forming streaks along rows of scales; snout above with black dots; fins pale, nearly plain; a dusky shade at base of caudal. (Jordan & Evermann.)

Caribbean Sea, north to western Florida. A small and very common species; 290 examples, 1.5 to 3 inches in length, from Ponce and Culebra.

Atherina laticeps Poey, Memorias, II, 265, 1861, Havana; Jordan & Evermann, l. c., 790, 1896.

65. **Atherina aræa** Jordan & Gilbert.

Head 4.5; depth 6; eye 2.6; snout 4; maxillary 2.7; mandible 2.3; interorbital 3.1; D. VI–I, 9; A. I, 12; pectoral 1.5; ventral 2.2; caudal 1.4; scales 41. Body more slender and head smaller and more pointed than in *A. laticeps* or *A. stipes;* maxillary scarcely reaching front of orbit.

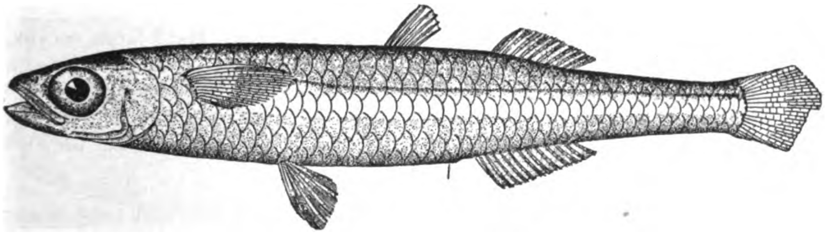

FIG. 23.—*Atherina aræa.*

Color of *A. stipes*, belly dusky behind vent; base of anal dusky, the color continued along caudal peduncle in a series of black dots; no black dots on sides.

Gulf of Mexico to Key West and Cozumel. Uncommon in Porto Rico; only four specimens, 2.5 inches in length, taken with *A. laticeps*, at Culebra.

Atherina aræa Jordan & Gilbert, Proc. U. S. N. M. 1884, 27, Key West; Jordan & Evermann, l. c., 790, 1896.

Family XXIX. MUGILIDÆ. The Mullets.

Body oblong, more or less compressed, covered with rather large cycloid scales; no lateral line, but the furrows often deepened on middle of each scale so as to form lateral streaks. Mouth small, jaws with small teeth, or none, teeth various in form; premaxillaries protractile. Gill-openings wide, membranes separate, free from isthmus. Branchiostegals 5 or 6. Gillrakers long and slender. Gills 4, a slit behind fourth. Pseudobranchiæ large. Two short dorsal fins, well separated, anterior with 4 stiff spines, last one of which is much shorter than the others; second dorsal longer than first, similar to the anal; anal spines 2 or 3, graduated; ventral fins abdominal, not far back, composed of 1 spine and 5 rays; caudal forked. Air-bladder large, simple. Intestinal canal long. Peritoneum usually black. Vertebræ 24.

The family comprises 8 or 10 genera and about 100 species, inhabiting the fresh waters and coasts of warm regions, feeding on organic matter contained in mud.

"In the genus *Mugil*, a considerable indigestible portion of the latter is swallowed, and in order to prevent larger bodies from passing into the stomach, or substances from passing through the gill-openings, these fishes have the organs of the pharynx modified into a filtering apparatus. They take in a quantity of sand or mud, and after having worked it for some time between the pharyngeal bones, they eject the roughest and indigestible portion of it. The upper pharyngeals have a rather irregular form; they are slightly arched, the convexity being directed toward the pharyngeal cavity, tapering anteriorly, and broad posteriorly. They are coated with a thick, soft membrane, which reaches far beyond the margin of the bone and is studded all over with minute horny cilia. Each branchial arch is provided with a series of long gillrakers, which are laterally bent downward, each series closely fitting to the sides of the adjoining arch; they constitute together a sieve admirably adapted to permit a transit for the water, retaining at the same time every solid substance in the cavity of the pharynx."

Of the 5 genera occurring in American waters, only 2 are represented in Porto Rico.

MUGILINÆ:

a. Stomach muscular, gizzard-like: teeth slender, usually having the form of cilia; lower jaw angular in front; species chiefly marine.

b. Anal spines 3: teeth ciliform, flexible.

c. Orbit with a well-developed adipose eyelid, covering part of iris; cilia in one or few series, slender; cleft of mouth chiefly anterior .... MUGIL, 44

bb Anal spines 2, first soft ray simple but articulate: teeth distinct, in a few series, scarcely ciliform, often obsolete in lower jaw; lips thin; no adipose eyelid; preorbital serrate .... QUERIMANA

AGONOSTOMINÆ:

aa. Stomach not gizzard-like: teeth not ciliform; lower jaw not angular in front; cleft of mouth lateral; fresh-water species, inhabiting chiefly mountain torrents in the Tropics.

d. Teeth in villiform bands.

e. Anal spines 2: teeth in bands on jaws and vomer; lower jaw without lamelliform folds .... AGONOSTOMUS, 45

dd. Teeth coarse, broad, truncate incisors, with their free edges serrate; smaller teeth on vomer; none on palatines; head heavy, the blunt, tumid snout overhanging the small, inferior mouth: lower jaw forming a sharp soft edge .... JOTURUS

Genus 44. MUGIL (Artedi) Linnæus. The Mullets.

Body oblong, somewhat compressed, covered with large scales. Head large, convex, scaled on sides and above. Mouth small, subinferior, the lower jaw angulated. Jaws with one or a few series of short, flexible, ciliform teeth; no teeth on vomer or palatines. Eye large, with a large adipose eyelid, which is little developed in the young. Stomach muscular, like the gizzard of a fowl.

Species very numerous, living on mud and running in great schools along the shores and in brackish lagoons of all warm regions.

a. Soft dorsal and anal fins almost naked: anal rays III, 8, rarely III, 7; sides with dark longitudinal stripes along rows of scales; caudal deeply forked, size large.

b. Scales about 33 in longitudinal series; depth about 4.5 in length to base of caudal, teeth very minute; distance from tip of pectoral to front of dorsal about two-sevenths the length of pectoral; lips rather thin..... *brasiliensis*, 66

bb. Scales about 41 in a longitudinal series; depth about 4 in length to base of caudal; teeth close-set, rather small; distance of tip of pectoral from front of dorsal about two-ninths the length of pectoral .... *cephalus*

aa. Soft dorsal and anal fins scaled, sides without dark stripes along rows of scales; caudal less deeply forked; size smaller.

c Anal rays III, 9. scales 35 to 45 in a longitudinal series.

d. Scales 42 to 45 in longitudinal series: teeth small .... *incilis*

dd. Scales 35 to 38 in longitudinal series.

e. Pectoral not nearly reaching origin of dorsal, distance from its tip to front of dorsal being in the adult one-sixth length of pectoral: teeth close-set, rather small, but distinctly visible without a lens; scales 38 or 39 in longitudinal series: dorsal less falcate .... *curema*, 67

ee. Pectoral nearly reaching origin of dorsal; scales 35 or 36 in longitudinal series; bare space between dentary bones small .... *gaimardianus*

cc. Anal rays III, 8: scales very large, about 33 in a longitudinal series: teeth wide-set, larger than in any other species except *setosus*, about as long as nostril; upper lip thick; pectoral not nearly reaching front of dorsal; size small .... *trichodon*, 68

66. Mugil brasiliensis (Agassiz). "*Liza*"; *Mullet; Lebrancho.*

Head 4; depth 5; eye 5.75; snout 4.5; interorbital 2; D. IV–I, 8; A. III, 8; scales 35–12.

Body long and slender, more so than in any other of our species; snout broad, blunt, and evenly rounded; profile from snout to dorsal fin almost straight; ventral outline somewhat more convex; top of head nearly flat; upper lip thin; preorbital large, almost covering maxillary; eye hidden in front and behind by a broad adipose membrane; teeth minute; scales large, about 21 between tip of snout and origin of spinous dorsal; soft dorsal and anal almost naked, caudal covered with fine scales at base; margin of soft dorsal and anal very concave; caudal deeply forked, the lobes equal, about as long as head; pectoral moderate, one-sixth in head, not reaching origin of spinous dorsal by a distance greater than diameter of eye; ventrals slightly shorter than pectoral.

Color, dusky above, silvery below; a dusky streak along each row of scales; scales on side and opercle with dark punctulations; ventrals pale-yellowish; other fins dusky.

Found from Cuba to Patagonia; common throughout the West Indies and along the coast of Brazil, and very common in Havana market, where it is known as "lebrancho." It is the most abundant mullet seen in the markets of Porto Rico, and perhaps the most abundant species of the family about the island. It is an important food-fish and is held in high esteem. Length, 16 to 18 inches.

Mugil brasiliensis Agassiz, in Spix, Pisc. Brasil., 234, pl. 72, 1829, Atlantic Ocean off Brazil: the types in the museum at Munich; Poey, Fauna Puerto-Riqueña, 335, 1881; Jordan & Evermann, l. c., 810, 1896.

Mugil liza Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 83, 1836, Brazil, Porto Rico, Maracaibo, Surinam, and Martinique.

Mugil lebranchus Poey, Memorias, II, 260, pl. 18, fig. 3, 1861, Cuba; Poey, Fauna Puerto-Riqueña, 335, 1881. Stahl, l. c., 78 and 164, 1883.

67. **Mugil curema** Cuvier & Valenciennes. *"Liza"; "Josea"; White Mullet.*

Head 4 to 4.4; depth 3.9 to 4.5; eye 4; snout 3.5; D. IV–I, 8; A. III, 9; scales 38,–11; interorbital width 2.6. Body moderately elongate; snout rather narrow and pointed; upper profile curved very slightly from snout to dorsal fin; ventral outline more convex. Upper lip rather thick; preorbital narrow, nearly covering maxillary posteriorly; eye with broad adipose membrane in front and behind; teeth thick-set, small, but distinctly visible to naked eye; scales small, about 23 from origin of dorsal to tip of snout; soft dorsal, anal, and caudal densely scaled; soft dorsal and anal concave; pectoral short, not reaching origin of spinous dorsal, longer in young; caudal deeply forked, the lobes nearly twice length of middle rays.

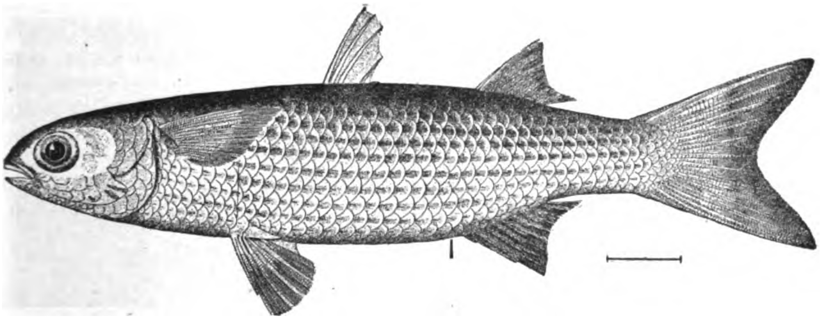

FIG. 24.—*Mugil curema.*

Color, dark-olive above, with steel-blue reflections, silvery below; no dusky streaks along side; a rather small dark blotch on base of pectoral; spinous and soft dorsals and pectoral pale, with numerous small dark punctulations; caudal pale, yellowish at base, margin dark; anal and ventrals yellowish; side of head with two yellowish blotches.

This species measures a foot or less. Next to *M. brasiliensis* it is the most abundant mullet about Porto Rico. Specimens are in the collection from San Juan, Aguadilla, Mayaguez, Ensenada del Boqueron, Arroyo, Fajardo, Vieques, Culebra, and Caguas. It has a very wide range, being found from Cape Cod to Brazil, and Magdalena Bay to Chile, and is generally common on both coasts of America, particularly in the Tropics. Its occurrence in fresh water in the Rio Grande at Caguas, some 40 miles from salt water, is of interest. It is found there in some numbers, and is one of the most important food-fishes of the region.

Mugil curema Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 87, 1836, Brazil, Martinique, and Cuba; Jordan & Evermann. l. c., 813, 1896.

Mugil petrosus Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 89, 1836, Brazil, Surinam, Gulf of Mexico, and Cuba.

68. **Mugil trichodon** Poey. *"Liza"; Fan-tail Mullet.*

Head 4.2; depth 3.6; eye 4; snout 3.5; interorbital width 2.5; D. IV–I, 8; A. III, 8; scales 33,–11. Body robust, depth somewhat greater than in *Mugil curema;* snout rather narrow and pointed; dorsal and ventral outlines about equally curved; upper lip thicker than in any other American species; preorbital narrow, covering little of maxillary; eye covered in front or behind by a broad, adipose membrane; teeth wide-set, larger than in most other species, about as long as nostril, and plainly visible in each jaw; scales large, about 21 between tip of snout and origin of dorsal fin; soft dorsal, anal, and caudal densely covered with fine scales; soft dorsal and anal concave; pectoral not reaching origin of dorsal; caudal broad, widely forked; caudal peduncle deep but thin.

Color, dusky-olive above with some bluish reflections, silvery below; no dusky streaks along rows of scales; a dark blotch on base of pectoral; dorsals and caudal pale, the former with very small dark punctulations; caudal margined with dark; anal and ventrals yellowish; pectoral pale, finely punctulate with brown.

This species reaches a length of 6 to 10 inches. It is found from Florida Keys to Brazil, and is abundant about Key West, but not about Cuba, and does not seem to be common about Porto Rico, the collection containing a single small specimen obtained at Puerto Real.

Mugil trichodon Poey, Ann. Lyc. Nat. Hist. N. Y., XI, 1875, 66, pl. 8, figs. 4 to 8, Cuba; Jordan & Evermann, l. c., 816, 1896

Genus 45. AGONOSTOMUS Bennett. The Dajaos.

Fresh-water mullets, with cleft of mouth extending laterally about to front of eye. Small teeth in villiform bands in both jaws, and sometimes on vomer. Edge of lower lip rounded, not sharp. Stomach not gizzard-like. Anal spines usually 2, first soft ray slender and often taken for a spine.

This genus occurs in streams of mountainous regions in tropical countries. The American species constitute the subgenus *Dajaus*, characterized by the presence of teeth on the palatines.

a. Interorbital space flat, narrow, 4 in head; head 3.66; depth 4.33 to 4.50; lips thin; scales 40 to 42,–13...... *percoides*
aa. Interorbital space convex, broad, 2.66 to 3 in head.
b. Lips thin; body rather deep; maxillary to front of eye .... *monticola*, 69
bb. Lips thick.
c. Maxillary short, barely reaching front of eye, 4 in head; eye 5 in head; head 4.25 in length .... *nasutus*
cc. Maxillary long, reaching posterior margin of pupil, 2.5 in head; eye very small, 6.5 in head; head 3.5 in length.................. .... *microps*

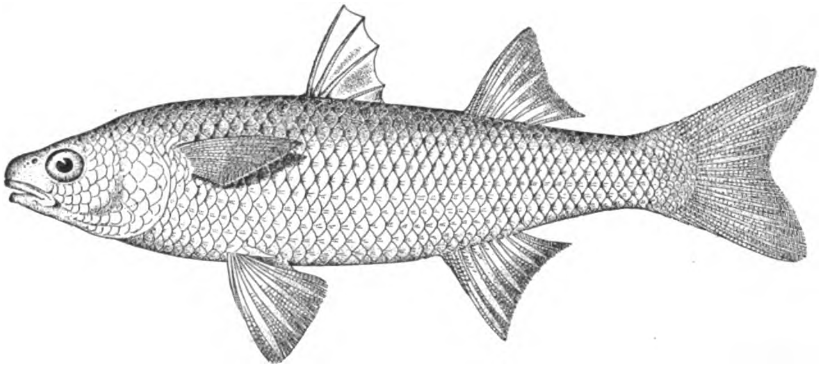

FIG. 25.—*Agonostomus monticola.*

69. Agonostomus monticola (Bancroft). "*Dajao.*"

Head 3.5; depth 3.8; eye 6; snout 3.4; maxillary 3; mandible 2.4; interorbital 2.9; D. iv–i, 8; A. iii, 9; pectoral 1.7; ventral 1.9; caudal 1.2; scales 42,–13.

Body elongate and compressed; back scarcely elevated; head very broad above and slightly convex; mouth moderate, upper lip broadened in front, maxillary reaching front of eye, lower jaw included; villiform teeth on each jaw, vomer, and palatines; eye much nearer tip of snout than edge of opercle; scales large, slightly ctenoid; dorsal fin as in *Mugil*, spinous dorsal with an appendage of 2 modified scales on each side of its base anteriorly; caudal large, moderately forked.

Color in life: Brownish above, scales very dark-edged on upper three-fifths of side; lower parts white; top of head dark, cheek and opercles white, with brassy shades; under part of head white; axil black; a black blotch at base of caudal, becoming faint or disappearing with age; dorsal spines dark; soft dorsal brassy at base, pale at tip; pectoral and ventral pale; anal yellowish, pale at tip, a black blotch near posterior border; caudal darker, yellowish at base; peritoneum black. In spirits not much different.

This species occurs in the fresh waters of the West Indies and eastern Mexico and is not uncommon. It is very abundant in the fresh-water streams of Porto Rico, and is much used as food; many were collected at Caguas in the Rio Loiza and Rio Caguitas and in Rio Bayamon at Bayamon, of all stages of growth from 1.5 to 11 inches; also common in the large spring at Aguadilla, from which Columbus is said to have supplied his ships with fresh water November 17, 1493.

Mugil monticola Bancroft, in Griffith's edition of Cuvier's Animal Kingdom, Fishes, 367, pl. 36, 1836.
Mugil irretitus Gosse, Nat. Sojourn Jamaica, 84, 1851, Jamaica.
Agonostomus monticola, Poey, Fauna Puerto-Riqueña, 335, 1881; Stahl, l. c., 164, 1883; Jordan & Evermann, l. c., 819, 1896.
Dajaus (*Agonostomus*) *monticola*, Stahl, l. c., 78, 1883.

Family XXX. SPHYRÆNIDÆ. The Barracudas.

Body elongate, subterete, covered with small cycloid scales; head very long, pointed, pike-like, scaly above and on sides; mouth horizontal, large; jaws elongate, the lower considerably projecting; upper jaw nonprotractile, its border formed by premaxillaries, behind which are the broad maxillaries; large, sharp teeth of unequal size on both jaws and on palatines, none on vomer; usually a very strong, sharp canine near tip of lower jaw. Opercular bones without spines or serratures. Gill-openings wide, gill-membranes not united, free from isthmus; gillrakers very short or obsolete. Branchiostegals 7; gills 4, a slit behind the fourth. Pseudobranchiæ well developed. Air-bladder large, bifurcate anteriorly; many pyloric cæca. Lateral line well developed, straight. Pectoral fin short, placed in or below line of axis of body; ventrals I, 5, abdominal, in advance of middle of body; first dorsal over ventrals, of 5 rather stout spines; second dorsal remote from first dorsal, similar to anal and opposite to it; caudal fin forked. Vertebræ 24. First superior pharyngeal not present; second, third, and fourth separate, with teeth; lower pharyngeals separate.

A single genus of about 20 species; carnivorous, pike-like fishes, often of large size, active and voracious, inhabiting warm seas, many of them highly valued as food.

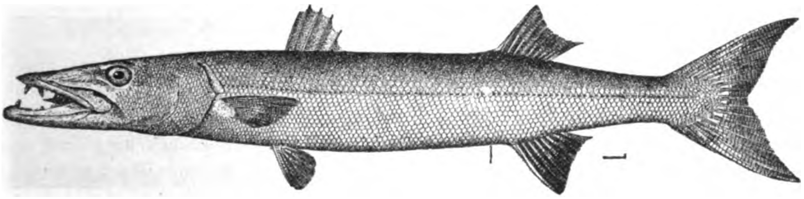

FIG. 26.—*Sphyræna barracuda.*

Genus 45. SPHYRÆNA (Artedi) Bloch & Schneider.

Characters of this genus included above.

a. Scales large, 75 to 85 in lateral line; origin of first dorsal behind root of ventrals, over last third or fourth of pectoral; body compressed; lower jaw with fleshy tip; maxillary reaching past front of orbit; teeth large ... *barracuda*, 70
aa. Scales moderate, 110 to 130 in lateral line; body subterete or compressed.
  b. Pectoral reaching front of spinous dorsal; maxillary reaching front of orbit; origin of spinous dorsal behind root of ventrals .... *guachancho*, 71
  bb. Pectoral not reaching front of first dorsal; maxillary not reaching front of orbit .... *picudilla*, 72
aaa. Scales very small, 150 to 170 in lateral line; origin of spinous dorsal well behind tip of pectoral, before the vertical from root of ventrals; lower jaw with fleshy tip. Body slender, subterete .... *sphyræna*

70. Sphyræna barracuda (Walbaum). "*Picuda.*"

Head 3.3; depth 7 (2 in head); eye 6.6; snout 2.1; maxillary 2.1; mandible 1.6; interorbital 5.1; D. v–I, 10; A. I, 8; pectoral 2.7; ventral 3.3; caudal 1.3; scales 12–83–11.

Body elongate, slightly compressed, head cuboid back of eyes, snout conic; mouth very large, lower jaw strongly projecting, with a fleshy tip at symphysis; maxillary reaching past front of eye; teeth on jaws, premaxillaries, and palatines unequal, very strong, sharp, and compressed; much smaller teeth on edges of premaxillaries; scales of trunk large, cycloid; smaller scales on cheeks and opercles; dorsal fins 2, widely separated, origin of first midway between front of eye and origin of soft dorsal; its spines slender and flexible; soft dorsal and anal similar; caudal well forked, upper lobe slightly the longer.

Color in spirits: Dark above, pale below, with silvery bluish reflections; dark longitudinal streaks along rows of scales above lateral line; young with dark, irregularly shaped blotches on middle of side, these often extended as vertical bars, disappearing with age; usually from one to several small, very dark brown spots, sometimes black, scattered irregularly on side; ventral, anal, and soft dorsal chiefly black; top of head, upper edge of maxillary, and edge of opercle above, black.

The picuda is common in the West Indies, ranging north to Charleston and the Bermudas, and south to Brazil. It is a fierce and voracious fish, of good food qualities. Thirteen examples, from 6 to 16 inches in length, were collected at San Juan market, San Antonio Bridge, Mayaguez, Ensenada del Boqueron, Culebra, Hucares, and Fajardo.

Umbla minor marina, the Barracuda, Catesby, Fishes of Carolina, etc., pl. 1, 1731, Bahamas.
Picuda, Parra, Dif. Piezas, Hist. Nat. Cuba, 90, pl. 35, fig. 2, 1787, Havana.
Esox barracuda Walbaum, Artedi Piscium, III, 94, 1792, Bahamas; after Catesby.
Sphyræna becuna Lacépède, Hist. Nat. Poiss., V, pl. 9, fig. 3, 1803, Martinique; from a drawing made by Plumier.
Sphyræna picuda Poey, Fauna Puerto-Riqueña, 334, 1881; Stahl, l. c., 76 and 162, 1883; Jordan & Evermann, l. c., 823, 1896.
Sphyræna barracuda, Jordan & Evermann, l. c., 2841, 1898.

71. **Sphyræna guachancho** Cuvier & Valenciennes. *Guachanche; Guachanche Pélon.*

Head 3; depth 7; eye 5.4; snout 2.1; maxillary 2.2; mandible 1.6; interorbital 7.2; D. v–i, 9; A. i, 8; pectoral 3; ventral 3.6; caudal 1.6; scales 115.

This species differs from *S. barracuda* in the much smaller scales, larger eye, longer and more slender head, and in the absence of color markings. The single specimen in the collection, 9 inches long, taken at Isabel Segunda, is nearly plain in spirits, save for fine dark longitudinal lines following the rows of scales above the lateral line. The back is of a faded brown color, the lower parts silvery white everywhere below lateral line; no regular bars or scattered spots.

The guachanche is a common West Indian species ranging north to Pensacola, and occasionally wandering in the Gulf Stream to Woods Hole. It does not reach as great size as the picuda.

Sphyræna guachancho Cuv. & Val., Hist. Nat. Poiss., III, 342, 1829, Havana; Jordan & Evermann, 1. c., 824, 1896.
Sphyræna guntheri Haly, Ann. Mag. Nat. Hist., XV, 1875, 270, Colon.

72. **Sphyræna picudilla** Poey. *Picudilla.*

Head 3.16; depth 2.25 in head; eye large, about 5 in head, 1.5 times interorbital space. D. v–i, 9; A. i, 9; scales 110. Body rather robust, subterete, covered with scales of moderate size; head rather large; maxillary rather small, about 2.6 in head, not reaching orbit. Jaw with fleshy tip, bluntly conical. Interorbital area flattish; median groove shallow, divided by a very indistinct median ridge; supraocular ridge bony, striate; preocular ridge rather prominent. Premaxillary teeth small, subconical; dentition as in *Sphyræna borealis*, but slightly weaker; position of spinous dorsal, in comparison with the ventrals, variable; distance from tip of snout to origin of spinous dorsal about 2.1 in body; pectoral not reaching spinous dorsal; space separating dorsals about 5.5 in body; second dorsal equal to and somewhat in advance of anal; cheek and opercles scaly; small embedded scales on upper part of head; scales on body moderate, uniform in size.

Color light-olive, darker above; soft dorsal, anal, and ventral fins yellowish; spinous dorsal and pectorals darker; upper parts of preopercle and opercle each with a dark spot; top of head and tip of snout blackish.

S. picudilla is very closely allied to *S. borealis*. Its eye is, however, much larger (when specimens similar in size are compared), and the frontal groove is somewhat different. This species is found in the West Indies, on the coasts of Cuba, ranging southward to Bahia. It was not seen by us in Porto Rico, but is included on the authority of Dr. Stahl. Length 18 inches.

Sphyræna picudilla Poey, Memorias, II, 162, 1860, Havana; Stahl, l. c., 76 and 162, 1883; Jordan & Evermann, l. c., 824, 1896.

Family XXXI. POLYNEMIDÆ. The Thread-fishes.

Body oblong, compressed, and covered with rather large, loosely inserted, ctenoid scales. Lateral line continuous, continued on tail, usually forked, with a branch on each lobe. Head entirely scaly; snout more or less conical, projecting over mouth, which is rather large, inferior, with lateral cleft; premaxillary protractile, its basal process vertical; maxillary without supplemental bone, extending much beyond eye, which is anterior, lateral, rather large, with a well-developed, adipose eyelid. Villiform teeth on jaws, palatines, and sometimes on vomer. Pseudobranchiæ concealed. Branchiostegals 7. Gill-membranes separate and free from isthmus. Gills 4, a slit behind fourth. Two separate dorsals, somewhat remote from each other, the first of 8 feeble but rather high spines, first and last spines very short, third longest; second dorsal equal to first in height but base somewhat longer, of soft rays only. Anal fin either similar to or much longer than soft dorsal; caudal fin rather long, widely forked. Second dorsal, anal, and caudal fins more or less covered with small scales; first three or four dorsal spines winged. Ventrals I, 5, abdominal, but not far removed from pectorals; pectoral fins moderate, placed low, in two parts, the lower and anterior portion of several filiform articulated appendages, free from each other, used as organs of touch.

In the young the dorsal, caudal, and pectoral fins are dusky, the anal and ventral fins white; all the fins grow darker with age, pectorals usually becoming black, operculum blackish.

Bones of skull with a well-developed muciferous system, as in *Sciænidæ*. Basis cranii double, with muscular tube; post-temporal bifurcate; hypercoracoid with median foramen; superior pharyngeal bones 4. Pectoral actinosts divided; two of them normal, supporting pectoral fin, one longitudinal, without rays, and one a plate on the coracoid, supporting the pectoral filaments. Stomach cæcal, with a few pyloric appendages. Air-bladder various, sometimes wanting. Vertebræ $10+14=24$.

a. Anal fin much longer than soft dorsal, of about 30 rays; vomer without teeth; preoperculum entire; free filaments of pectoral longer than body .... POLYNEMUS

aa. Anal fin not much longer than soft dorsal, of about 13 or 14 rays; vomer with teeth; preoperculum serrate; free filaments of pectoral mostly shorter than body .... POLYDACTYLUS, 47

Genus 47. POLYDACTYLUS Lacépède.

Anal fin not much longer than soft dorsal, of about 13 or 14 rays; vomer with teeth; preoperculum serrate; free filaments of pectoral mostly shorter than body. Teeth in villiform bands on both jaws, vomer, palatines, and pterygoids. Preopercle sharply serrated on its posterior margin, its angle with a scaly flap. Scales rather small, finely ctenoid. First dorsal with 7 or 8 feeble, rather high spines, first and last short. Soft dorsal and anal fins about equaling each other; pectoral filaments 3 to 9. Pyloric cæca in great numbers.

This genus is represented by numerous species occurring in the warm seas; but of four American species only one is known from Porto Rico.

a. Pectoral filaments 7 .... *virginicus*, 73

aa. Pectoral filaments 8 or 9 .... *octonemus*

73. Polydactylus virginicus (Linnæus). *"Barbudo"; Barbu.*

Head 3.3; depth 3.25; eye 5; snout 4.8; maxillary 2.2; mandible 2; interorbital 4.2; D. VIII–I, 12; A. III, 13; pectoral 1.25; ventral 2.2; caudal 0.9; scales 7–60–10.

Body oblong, compressed, covered with large, loose, slightly ctenoid scales; the lateral line complete, nearly straight, bifurcating at base of caudal, the branches continued on tail; head completely scaled except about eye, which is entirely covered with an adipose eyelid; snout somewhat pig-like, overhanging the rather large mouth; maxillary reaching far beyond eye; lower jaw included, villiform teeth on jaws, vomer, and palatines; preopercle toothed; dorsal fins 2, well separated, the anterior of weak flexible spines, the first very short, third longest, 1.5 in head, the rest rapidly diminishing in length; pectoral with a large sheath of elongated scales above axil and with 7 long filaments, longer than head, inserted considerably in advance of base of pectoral; caudal deeply forked; all the fins more or less scaly.

Color in life: Whitish-olive above, dirty white below; spinous dorsal dark, soft dorsal and anal pale, with dark punctulations; pectoral with irregular black blotches, filaments white; ventrals dark, paler on margins. In spirits: Pale below, darker above; pectoral fin black; opercle with a dusty blotch in young.

The barbudo is an abundant and useful food-fish, found throughout the West Indies and north to Florida Keys, but not to Virginia. Twenty-three examples of all sizes up to 11 inches in length were collected at San Juan market, Palo Seco, Mayaguez, Puerto Real, Ponce, and Isabel Segunda.

Piracoaba, Marcgrave, Hist. Nat. Brasil., 176, 1648, Brazil.

Polynemus virginicus Linnæus, Syst. Nat., ed. X, 317, 1758, America.

Polynemus mango Lacépède, Hist. Nat. Poiss., V, 413, 417, 418, 1803, America; after Linnæus.

Polydactylus plumierii Lacépède, Hist. Nat. Poiss., V, 419, 1803, Martinique; from a drawing by Plumier.

Polynemus americanus Cuvier & Valenciennes, Hist. Nat. Poiss., III, 393, 1829, Santo Domingo and Martinique.

Polynemus oligodon Günther, Cat., II, 322, 1860, Rio Janeiro.

Trichidion plumieri, Poey, Fauna Puerto-Riqueña, 334, 1881; Stahl, l. c., 78 and 164, 1883.

Polydactylus virginicus, Jordan & Evermann, l. c., 829, 1896.

Family XXXII. HOLOCENTRIDÆ. The Squirrel-fishes.

Body oblong or ovate, moderately compressed, covered with very strong ctenoid or spinous scales. Head with large muciferous cavities; eye lateral, very large; preorbital very narrow; mouth moderate, oblique; premaxillaries protractile; maxillary very large, with supplemental bone; bands of villiform teeth on jaws, vomer, and palatines. Opercular bones and membrane bones of head generally serrated or spinescent along their edges. Branchiostegals 8. Gill-membranes separate, free from isthmus. Gills 4, a slit behind fourth. Pseudobranchiæ present. Gillrakers moderate; no barbels. Sides of head scaly. Lateral line present. Dorsal fin very long, deeply divided, with about 11 strong spines depressible in a scaly groove; anal with 4 spines, the third longest and strongest; ventrals thoracic, with 1 spine and 7 rays; caudal deeply forked with sharp rudimentary rays or fulcra at base. Vertebræ about 27. Pyloric cæca 8 to 25. Air-bladder large, sometimes connected with organ of hearing. General color, red. Young with snout sharp and produced (constituting the nominal genera *Rhynchichthys*, *Rhamphoberyx*, and *Rhinoberyx* based on peculiarities of immature examples).

There are 4 genera and about 70 species of these gayly colored inhabitants of the tropical seas, abounding about coral reefs.

a. Preopercle without conspicuous spine at its angle; air-bladder divided by a contraction, anterior part extending to the otocrane .... MYRIPRISTIS
aa. Preopercle with a conspicuous spine.
b. Suborbital arch armed with 3 long spines curved forward; scales undescribed .... PLECTRYPOPS
bb. Suborbital arch simply serrated; scale moderate, 38 to 55.
c. Mouth moderate, its length less than one-half head .... HOLOCENTRUS, 48
cc. Mouth very large, considerably more than one-half head, lower jaw projecting .... FLAMMEO

Genus 48. HOLOCENTRUS (Gronow) Scopoli.

Body oblong, moderately compressed, ventral outline nearly straight, back a little elevated, tail very slender. Head compressed, narrowed forward. Operculum with a strong spine above, below which the edge is sharply serrated; a strong spine at angle of preopercle. Orbital ring, preorbital, preopercle, interopercle, subopercle, occiput, and shoulder-girdle with their edges sharply serrate. Mouth small, terminal, the lower jaw projecting in adult. In the young the snout is much produced. Maxillary broad, striate, with supplemental bone. Eye excessively large. Scales moderate, closely imbricated, posterior margin strongly spinous. Lateral line continuous. Dorsal deeply emarginate, spines usually 11, depressible in a groove; soft dorsal short and high; anal with 4 spines, first and second quite small, third very long and strong, fourth smaller; caudal widely forked, both lobes with rudimentary rays spine-like. Ventrals large, I, 7, spine very strong.

The numerous species of this genus are remarkable for the development of sharp spines almost everywhere on the surface of the body. Of the nine known American species, two occur in Porto Rico.

a. Preopercular* spine long, tapering, acute; third anal spine very long, more than half depth of body.
b. Mouth moderate, lower jaw extending to below first one-third to one-half length of eye.
c. Scales small, 48 to 55 in lateral line; upper lobe of caudal longer than lower, falcate; soft dorsal and anal elevated, pointed at tip, this character subject to variation .... *ascensionis*, 74
cc. Scales moderate, about 45; depth of body 2.6 in length; membrane of front spines of dorsal black .... *siccifer*
ccc. Scales rather large, 38 to 42 in lateral line; caudal lobes nearly or quite equal.
d. Maxillary extending to below middle of eye.
e. Depth of body greater than length of head .... *coruscus*
ee. Depth of body equal to length of head .... *brachypterus*
dd. Maxillary extending to below first third of eye; dorsal with black markings .... *vexillarius*, 75
bb. Mouth small, maxillary reaching to below first fourth of eye; upper lobe of caudal longer; cheek with a white blotch .... *osculus*
aa. Preopercular spine short, flattish, notched at tip; third anal spine short, its length about one-third depth of body; soft dorsal and anal low, rounded .... *sancti-pauli*

74. Holocentrus ascensionis (Osbeck). "*Candil*"; *Squirrel-fish*.

(PLATE 8.)

Head 3.1; depth 3.3; eye 2.8; snout 4; maxillary 2.3; mandible 2; interorbital 2 in eye; D. XI, 15; A. IV, 10; scales 4–48–7, 6 before dorsal; cæca 25; vertebræ 11 + 16. Body considerably compressed, back moderately elevated, ventral line nearly straight; mouth moderate, little oblique, maxillary reaching middle of eye; caudal peduncle long and slender, least width 2 in its depth. Fins all well developed, longest dorsal spine about 2 in head; third anal spine very strong, about 2 in head; longest dorsal rays 1.2 in head; longest anal ray 1.8; pectoral short, 1.6 in head; ventral long, reaching vent, 1.1 in head; caudal well forked, upper lobe the longer, about 1.1 in head; head very rugose; suborbital coarsely and irregularly dentate; opercle and preopercle strongly dentate; a large sharp spine at angle of preopercle, its free portion about 1.5 in eye; a broad flat spine at upper edge of opercle; scales coarse and strongly ctenoid.

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* Little dependence can be placed on this key, as several species are imperfectly known and of doubtful validity.

Color in life: Chiefly bright rosy-red, paler below; shining longitudinal streaks along rows of scales; fins light-red, spinous dorsal largely golden-olive, its edge scarlet; head very red above, a white bar descending obliquely backward from eye. All these colors fade in alcohol, and the general color becomes a greenish-white, with steel-colored iridescence.

The candil frequents the rocks and reefs throughout the West Indies and is especially abundant in Cuba. It is common about Porto Rico, and attracts attention at once by reason of its bright color and the exceeding sharpness and completeness of its armature. It is reputed "malo" by the native, but is occasionally found in market. Length 1 to 2 feet. Specimens were obtained at San Juan, Aguadilla, Puerto Real, Arroyo, Hucares, Isabel Segunda, and San Geronimo.

Perca ascensionis Osbeck, Iter Chinensis, 388, 1771, Ascension Island.
Bodianus pentacanthus Bloch, Ausl. Fische, IV, 40, pl. 225, 1790, Brazil.
Holocentrus sogo Bloch, l. c., 61, pl. 232, 1790, Africa.
Sciæna rubra Bloch & Schneider, Syst. Ichth., 82, 1801; after *Perca marina rubra* of Catesby.
Amphiprion matejuelo Bloch & Schneider, l. c., 206, 1801, Cuba; after *Matejuelo* of Parra.
Bodianus jaguar Lacépède, Hist. Nat. Poiss., IV, 286, 1202, Brazil; after *Jaguaraca* of Marcgrave.
Holocentrum longipinne Cuvier & Valenciennes, Hist. Nat. Poiss., III, 185, 1829, Martinique, Santo Domingo, Porto Rico, St. Thomas, and Havana.
? *Holocentrus striatus* Gronow, Cat. Fishes, ed. Gray, 173, 1854, Antilles; name preoccupied.
? *Holocentrus rostratus* Gronow, l. c., 173, 1854, near the Equator; young example, not certainly identifiable.
Holocentrum matejuelo, Poey, Fauna Puerto-Riqueña, 322, 1881; Stahl l. c., 76 and 162, 1883.
Holocentrus ascensionis, Jordan & Evermann, l. c., 848, 1896.

75. **Holocentrus vexillarius** Poey.

Head 2.8; depth 2.6; eye 2.7; snout 4.4; maxillary 3; mandible 2.25; interorbital 3.5; D. XI, 13; A. IV, 9; pectoral 1.4; ventral 1.6; caudal 1.5; scales 4-40-7.

Body oblong, back little elevated, anterior profile steep and nearly straight from tip of snout to above eye, where there is an abrupt angle, rest of profile to nape being low and straight; interorbital wide, slightly concave; top of head behind eyes with about 9 serrated bony ridges on each side; eye very large, considerably wider than interorbital space; snout short; maxillary reaching front of eye (to first third of eye in example 2 inches long); preorbital with a recurved spine in front, retrorse teeth back of this, finer and more numerous serrations continuing nearly halfway around eye; a pair of strong equal spines near upper angle of opercle; several much smaller spines above, of which 3 are somewhat enlarged, longest dorsal spines 2.1 in head; anterior rays of dorsal somewhat produced, 2 in head; scales at base of spinous dorsal with their serrations next the fin enlarged; ventrals not reaching vent; second anal spine longest and much the strongest, 1.5 in head; caudal well forked; lobes nearly equal.

Color in spirits: Faded-rosy, 6 narrow longitudinal very dark-purple bands between each 2 rows of scales on dorsal half of side; below, brown punctulations in same position and scattered more or less over whole body; axil of pectoral very dark-purple, the color sharply circumscribed; membrane of spinous dorsal white behind each spine and purple-black in front, except first 2 spines, the membranes of which are chiefly black; other fins pale.

Two examples, 2 and 4 inches in length, from Ponce and Guanica, are identical with specimens of *Holocentrum riparium* from Cuba in the U. S. National Museum. Following Jordan & Evermann, we include *H. riparium* in the synonymy of *H. vexillarius*, though these species may prove to be distinct.

Holocentrum vexillarium Poey, Memorias, II, 158, 1860, Cuba.
Holocentrum productum Poey, Synopsis, 300, 1868, Matanzas; based on a young individual 3 inches long.
Holocentrum riparium Poey, Enumeratio, 37, 1875, Cuba.
Holocentrus vexillarius, Jordan & Evermann, l. c., 852, 1896.

Family XXXIII. MULLIDÆ. The Surmullets.

Body elongate, slightly compressed, covered with large scales, which are usually slightly ctenoid; lateral line continuous, the pores often branched; large scales on head; upper profile of head more or less parabolic. Mouth small, low, subterminal; teeth mostly small, variously placed; no canines, incisors, nor molars. Premaxillaries somewhat protractile; maxillaries thin, nearly as broad at base as at tip, without supplemental bone, partly hidden by broad preorbital. Preopercle entire or slightly serrate; opercle unarmed, or with a single spine. Eye moderate, placed high; branchiostegals 4; pseudobranchiæ present; 2 long unbranched barbels at throat, attached just behind symphysis of lower jaw. Dorsal fins 2, remote from each other, both short, the first of 6 to 8 rather high spines, which are depressible in a groove; anal short, similar to soft dorsal, with 1 or 2 small spines; ventrals thoracic, I, 5. Air-bladder usually present, simple. Vertebræ 9 + 14 = 23; stomach siphonal; pyloric cæca about 20.

Species about 40, referable to 5 closely related genera, found in all tropical seas, some species straying northward. Many of the species are highly valued as food, especially the European *Mullus barbatus* and *M. surmuletus*. The family is a very natural one and not closely related to any other. It bears some superficial likeness to the *Sciænidæ* and *Cheilodipteridæ*, but this may not show real affinity. The singular barbels appear also in *Polymixiidæ*, but in that family the ventral rays are numerous, as in *Berycidæ*. The small number (4) of the branchiostegals is found both in *Mullidæ* and *Polymixiidæ*.

a. Teeth on lower jaw, vomer, and palatines; upper jaw toothless; bone which forms a downward hook over maxillary strongly developed; interorbital space flat and wide; opercle without spine .... MULLUS

aa. Teeth on both jaws; vomer and palatines toothless; bone which forms a downward hook over maxillary moderately developed; interorbital space rather narrow; opercle ending in a single spine .... UPENEUS, 49

Genus 49. UPENEUS Cuvier. The Goat-fishes.

Body oblong, compressed; mouth moderate, nearly horizontal, low, jaws subequal; eye large high, posterior; opercle short, deep, with posterior spine; both jaws with rather strong, unequal teeth, in one or two series in each jaw; no teeth on vomer or palatines; lips well developed; bone which forms a hook over the maxillary less developed than in *Mullus;* interorbital space concave and narrow; opercle ending in one spine; barbels nearly as long as head; scales very large, somewhat ctenoid; lateral line continuous, its tubes ramifying on each scale; head covered with large scales; first dorsal with about 7 spines; anal with 2, the first very short; caudal fin forked.

Species numerous in the tropical seas; two known from Porto Rico.

a. Teeth in both jaws uniserial (or irregularly biserial above); all teeth coarse and distinct; eye 4 in head; barbels 1.33 in head. Scales 31; depth 4 in length; side with three black blotches .... *maculatus*, 76

aa. Teeth of both jaws biserial, at least in front.

b. Dorsals and caudal with dark crossbands .... *parvus*, 77

bb. Dorsals and caudal plain-yellow .... *martinicus*, 78

76. **Upeneus maculatus** (Bloch). "*Salmonete*"; *Red Goat-fish.*

(PLATE 4.)

Head 3.2; depth 3.7; eye 4 to 5; snout 1.8; maxillary 3.2; mandible 2.4; interorbital 3.7; preorbital 3.33; D. VIII–I, 8; A. II, 7; pectoral 1.5; ventral 1.4; caudal 1.3; scales 3–30–5.

Body elongate, little compressed, tapering posteriorly to the long and slender caudal peduncle; anterior profile strongly arched, with an elevation in front of eye; snout very long; eye small, high and posterior; mouth small, maxillary not nearly reaching eye; teeth strong, uniserial, bluntly pointed, some of those in front of upper jaw bent variously sidewise and forward; throat with two long barbels reaching to preopercular margin or beyond. Scales large, very finely ctenoid. Dorsal fins 2, well separated, the spines slender and flexible; caudal deeply forked, lobes equal or upper very slightly the longer.

Color: In life, everywhere above red, merging into light-yellow on sides, becoming pale-greenish below; bluish oblique streaks and bars on head; several longitudinal rows of light-blue round spots, much smaller than pupil, on sides, the two rows above lateral line plainest; about four diffuse blotches of darker red than the surrounding ground-color on sides, the first just under and partly on anterior end of lateral line, second under first dorsal, third under front of second dorsal, fourth just behind second dorsal, all on or near lateral line; there may be an additional faint one on peduncle; spinous dorsal light-red near base, yellowish outwardly; soft dorsal mostly pale-bluish, especially near edge, with some light-yellow on membrane and red on middle of rays; pectoral chiefly yellow, with red on rays; ventral pale-blue with streaks of red and yellow on first rays; anal pale-reddish, nearly pale; caudal pale-blue, lower base yellow, upper reddish and yellow; barbels pink near base, yellow outwardly; lips and throat pinkish. In spirits the specimens become pale below and on sides, dark above, the bright colors fading quickly; the red blotches along lateral line become dark, sometimes entirely fading. In young individuals some color occasionally persists in spirits, becoming pink.

This species is found at Key West and the Tortugas, through the West Indies to Brazil; in the West Indies it is known from Cuba, Jamaica, Porto Rico, and Martinique. It occurs in abundance in Porto Rico, where it is extensively used as food and considerably esteemed. It is one of the most common species that one sees carried about the streets by the local fishermen. Fifty-one individuals, from 2.25 to 9.5 inches long, collected at nearly every collecting station; also from San Geronimo.

Mullus maculatus Bloch, Ichthyologia, 348, 1793, Brazil.
Upeneus punctatus Cuvier & Valenciennes, Hist. Nat. Poiss., III, 482, 1829, Martinique.
Upeneus maculatus, Jordan & Evermann, l. c., 858, 1896.

77. **Upeneus parvus** Poey.

D. VII–I, 8; A. II, 6; scales 2.5–40–6. Snout short and decurved; maxillary reaching front of eye; barbels reaching angle of preopercle, on jaws only. Teeth conical, very small, on anterior part of jaws in two series; lateral teeth in a single series; all of the teeth obtusely conic and distinct from each other. Vermilion above, fading into white below; a yellow longitudinal band along side, with similar narrower streaks below; ventrals and anal yellow; other fins whitish, with dusky crossbands, 3 on first dorsal, 2 on second, and 5 on each caudal lobe. Known only from the type, which was obtained by Poey in Cuba, and from a specimen recorded from Porto Rico by Dr. Stahl.

Upeneus parvus Poey, Memorias, I, 226, 1851, Cuba.
Upeneoides parvus Stahl, l. c., 76 and 162, 1883.

78. **Upeneus martinicus** Cuvier & Valenciennes. *Yellow Goat-fish; Salmonete Amarilla.*

(PLATE 5.)

Head 3.3; depth 4; eye 3.45; snout 2.35; maxillary 3.1; mandible 2.6; interorbital 3.15; preorbital 6; D. VIII–I, 8; A. II, 6; pectoral 1.6; ventral 1.4; caudal 1.1; scales 2–37–6. Resembling *U. maculatus* in form, but with slightly larger eye, smaller scales, and weaker dentition arranged in more than one series.

Color in life: Body with shades of pale-blue and pink or pale-red, the latter chiefly above, the blue below; a straight yellow band from eye to base of upper caudal rays; a black vertical bar at base of caudal; head with yellow streaks and reddish patches; pectorals red, ventrals, anal, and caudal reddish near base, outer part yellow; dorsals yellow, plainest near tips. In spirits the colors fade, becoming dark above, pale below, fins all pale.

This species reaches the length of a foot. It is found in the West Indies north to Florida, and is known from Key West, Jamaica, Cuba, Martinique, and Porto Rico, but is less abundant in Porto Rico than *U. maculatus*. One example, 6.5 inches long, obtained at Palo Seco.

Upeneus martinicus Cuv. & Val., Hist. Nat. Poiss., III, 483, 1829, Martinique; Jordan & Evermann, l. c., 859, 1896.
Upeneus balteatus Cuvier & Valenciennes, Hist. Nat. Poiss., III, 484, 1829, Cuba; young.
Upeneus flavovittatus Poey, Memorias, I, 224, 1851, Cuba; adult.

Family XXXIV. SCOMBRIDÆ. The Mackerels.

Body elongate fusiform, not much compressed, covered with minute cycloid scales; scales anteriorly sometimes forming a corselet. Lateral line present, its course undulate. Head subconic, pointed anteriorly. Mouth rather large, with lateral cleft; premaxillaries not protractile; maxillary without supplemental bone; jaws with sharp teeth, large or small. Vomer and palatines toothed or not. Preopercle entire; opercle unarmed. In the very young the preopercle is armed with radiating spines, which are later absorbed and lost. Gill-openings very wide, membranes not united, free from isthmus. Gillrakers usually long. Pseudobranchiæ present, large. Gills 4, a slit behind fourth. Branchiostegals 7. Dorsal fins 2, the first of rather weak spines, depressible in a groove, second similar to the anal; elevated anterior lobe always distinct; anal spines weak; last rays of dorsal and anal detached and separate, forming in each case a series of finlets; caudal peduncle extremely slender, keeled, caudal lobes abruptly diverging, falcate, fin adapted for rapid motion; ventral fins well developed, thoracic, I, 5.

Vertebræ in greater number than in the *Carangidæ*, the number ranging from 31 to 66. First upper pharyngeal present, without teeth; second with teeth; third and fourth coossified, with teeth; lower pharyngeals separate. Stomach sac-shaped. Pyloric cæca numerous. Air-bladder small, sometimes absent. Coloration metallic, often brilliant, the prevailing shade steel-blue.

The *Scombridæ* comprise about 12 genera and 60 species; of the 8 American genera only 2 are represented in Porto Rican waters. These fishes are inhabitants of the high seas, all having a wide range, and many of them being cosmopolitan. Most of them are valued as food-fishes, the flesh being firm and oily, but sometimes coarse.

a. Dorsal spines 10 to 16; gills normal, the laminæ not forming a network; teeth entire.
b. Body scaleless, excepting about lateral line and corselet; abdominal vertebræ with their lower foramina enlarged and a portion between vertebræ proper and hæmapophyses developed in form of a network or trellis.
c. Dorsals well separated, interspace more than half head; corselet well developed; teeth small, some present on vomer, none on palatines; gillrakers long, slender, and numerous; pectorals rather high; vertebræ 39. AUXIS, 50
cc. Dorsals contiguous, interspace more than 5 in head; palatine teeth villiform; pectorals low.
d. Vomer toothless; dorsal spines 15 or 16; vertebræ 38 .... GYMNOSARDA
bb. Body wholly covered with small scales, those on corselet and lateral line sometimes larger; dorsal spines 14 to 26; vertebræ normally formed, not as in *Auxis* and *Gymnosarda*.
e. Teeth of jaws slender, subconical, little, if at all, compressed; gillrakers numerous; corselet distinct; pectoral inserted low.
f. Vomer and palatines with villiform or sand-like teeth; body robust, not compressed; vertebræ 39 to 41.
g. Pectoral short, not reaching much beyond tip of the moderate ventral; size enormous.................... THUNNUS
gg. Pectoral very long, ribbon-shaped, reaching much beyond front of anal; size moderate.................... GERMO
ff. Vomer toothless; palatines with a single row of rather strong, conical teeth; body elongate, slightly compressed; vertebræ 50 to 54.................... SARDA
ee. Teeth of jaws strong, subtriangular or knife-like, more or less compressed; villiform teeth on vomer and palatines; gillrakers comparatively few; corselet obscure; pectorals inserted near level of eye; dorsal spines 14 to 18; body elongate, compressed; head short; snout short; vertebræ 45 .... SCOMBEROMORUS, 51

ACANTHOCYBIINÆ:
aa. Dorsal spines about 25; gills with laminæ forming a network, as in *Xiphias*; teeth large, compressed, serrated.
h. Dorsal spines 24 to 26; body elongate, fusiform; snout long; vertebræ 32 + 34 = 66.................... ACANTHOCYBIUM

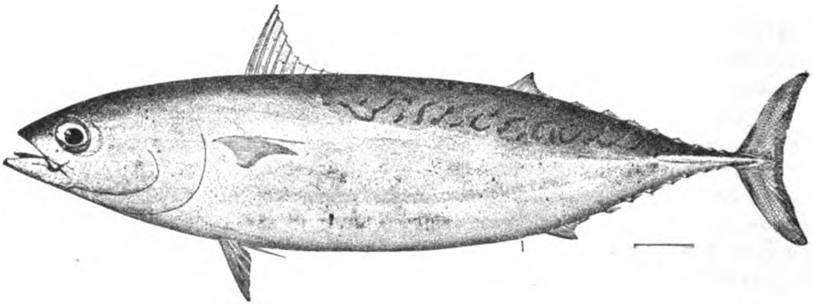

FIG. 27.—*Auxis thazard.*

Genus 50. AUXIS Cuvier. The Frigate Mackerels.

Body oblong, plump, mostly naked posteriorly, anteriorly covered with small scales, those of pectoral region enlarged, forming a corselet. Snout very short, conical, scarcely compressed. Mouth rather small, jaws equal. Teeth very small, mostly in a single series, on jaws and vomer only. Tail very slender, depressed, with a rather large keel on each side. First dorsal short, separated from second by a considerable interspace. Second dorsal and anal small, each with 7 or 8 finlets. Pectorals and ventrals small. No air-bladder. Branchiostegals 7. Pyloric cæca dendritical. Gillrakers very long and slender, numerous. Vertebræ 39 in number, peculiarly modified, essentially as in *Gymnosarda*.

One pelagic species, widely distributed.

79. **Auxis thazard** (Lacépède). *"Albacora"; Frigate Mackerel.*

Head 3.8; depth 4.4; eye 6; snout 3.7; mandible 2.2; interorbital 3.2; D. X–12–VIII; A. 13–VII; pectoral 1.8; ventral 2.25; caudal 1.4.

Body elongate, robust, scaleless, save for a corselet of moderate and very small scales about anterior part of trunk and along lateral line; caudal peduncle long and slender, with lateral keel; weak conical teeth in jaws only; first dorsal of flexible spines, the first three elevated, the rest graduated to last, which is very short; soft dorsal and anal small, somewhat falcate, followed by detached finlets; caudal widely forked.

Color in spirits: Bluish above, very deep purple, almost black, on upper part of head; oblique dark bars and stripes, somewhat as in *Scomber*, on sides of back; silvery white below; several large, regular, dark blotches, not sharply circumscribed, on the lower part of side of trunk anteriorly; pectoral and ventral purple, black on inner side, on outer side pectoral paler, ventral white.

This species is found in all warm seas, occasionally northward to Cape Cod. It is very erratic in its movements, swimming in large schools. It rarely reaches the coasts of the United States, but occasionally comes in immense numbers. It is a poor fish, of little value as food. It is probably not rare about Porto Rico; examples were seen at Arecibo, where one 15 inches long was obtained.

Scomber thazard Lacépède, Hist. Nat. Poiss., II, 9, 1802, between 6° and 7° S. lat., off coast of New Guinea.
Scomber rochei Risso, Ichth. Nice, 165, 1810, Nice.
Scomber bisus Rafinesque, Caratteri, etc., 45, 1810, Palermo.
Thynnus rocheanus Risso, Eur. Mérid., III, 417, 1827, Nice.
Auxis vulgaris Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 139, 1831, Mediterranean.
Auxis tapeinosoma Bleeker, Fauna Japon., 408, 1854, Japan.
Auxis thynnoides Bleeker, Ternate, V, 301, 1855, Ternate.
Auxis thazard, Jordan & Evermann, l. c., 867, 1896.

Genus 51. SCOMBEROMORUS Lacépède.

Body elongate, wholly covered with rudimentary scales, which do not form a distinct corselet. Head pointed, comparatively short and small. Mouth wide, the strong teeth in the jaws more or less compressed or knife-shaped; villiform or sand-like teeth on the vomer and palatines; maxillary not concealed by preorbital. Gillrakers few. Caudal peduncle with a single keel. Spinous dorsal low, of 14 to 18 feeble spines. Soft dorsal and anal short, similar, somewhat elevated and falcate, each followed by 7 to 10 finlets; ventrals small; pectorals moderate, near level of eye. Air-bladder present. Vertebræ normally formed, 45 in number.

Fishes of the high seas; graceful in form and beautiful in color, and among the best of food-fishes.

a. Soft dorsal inserted in advance of anal .... *maculatus*, 80
aa. Soft dorsal inserted over anal.
  b. Body deep, the depth about 5 in length; teeth about 40 in each jaw .... *regalis*, 81
  bb. Body more slender, the depth about 6 in length .... *cavalla*, 82

80. Scomberomorus maculatus (Mitchill). "*Carita*"; *Spanish Mackerel*.

(Plate 6.)

Head 4.5; depth 4.5; D. xvii–18–ix; A. ii–17–ix; maxillary 1.8 in head; eye 4.75; pectoral 1.75; ventral 4.5; dorsal and anal lobes subequal, 2. Body elongate, its dorsal and ventral outlines equal; profile straight from snout to dorsal; head small and pointed; mouth large, oblique, jaws equal; maxillary reaching posterior margin of orbit; teeth large, compressed, and sharp, their formula being 24–24 to 32–32; gillrakers $2 + 11$. Soft dorsal inserted in advance of anal a distance about equal to diameter of eye; lateral line undulating, with about 175 pores.

Color silvery, bluish above; sides with many elliptical spots of dull orange-color, two rows of these spots below lateral line and one row above; spinous dorsal white at base, black above; soft dorsal tinged with yellowish, its margins black; anal white; posterior side of pectoral black, anterior side yellowish with black borders; caudal blackish.

This species is found on both coasts of North America, appearing in large but very irregular schools in the Gulf of Mexico and along the Carolina coast; ranging north in the fall as far as Cape Ann, and south to Brazil. It is rare or unknown in Cuba, but is known from Jamaica and Porto Rico. It reaches a weight of 8 or 9 pounds and is one of the very best food-fishes in the United States.

Scomber maculatus Mitchill, Trans. Lit. & Philos. Soc. N. Y., I, 1815, 426, New York.
Scomberomorus maculatus, Jordan & Evermann, l. c., 874, 1896.

81. **Scomberomorus regalis** (Bloch). *Sierra; Pintado.*

Head 4.25; depth 5.2; eye 5.8; snout 2.5; maxillary 1.8; mandible 1.6; interorbital 3.5; D. xviii–14–ix; A. ii–15–viii; pectoral 1.9; ventral 4.2; caudal 1 1. Lateral line descending gradually from opposite last dorsal spines to caudal peduncle, slightly undulate; maxillary reaching posterior border of orbit.

Color in spirits: Silvery below, dark-blue above; side with a blackish longitudinal band from base of pectoral nearly to base of caudal, crossing lateral line under soft dorsal, somewhat interrupted posteriorly; below this a row of oblong dark spots forming an interrupted band; a few other faint spots at border of dark color of back; anterior portion of spinous dorsal black.

Cape Cod to Brazil; not very common on our south Atlantic coast, but abundant about Cuba; known also from Jamaica, Martinique, and Porto Rico. One 16 inches long from Puerto Real, and others seen.

Scomberomorus regalis Bloch, Ichthyol., pl. 333, 1795, Martinique; after a drawing by Plumier.
Scomberomorus plumieri Lacépède, Hist. Nat. Poiss., III, 292, 1806, Martinique; after Aubriet's copy of drawing by Plumier.
Cybium acervum Cuvier & Valenciennes, Hist Nat. Poiss., VIII, 186, 1831, Cuba.
Cybium regale, Poey, Fauna Puerto-Riqueña, 331, 1881; Stahl, l. c., 77 and 163, 1883.
Scomberomorus regalis, Jordan & Evermann, l. c., 875, 1896.

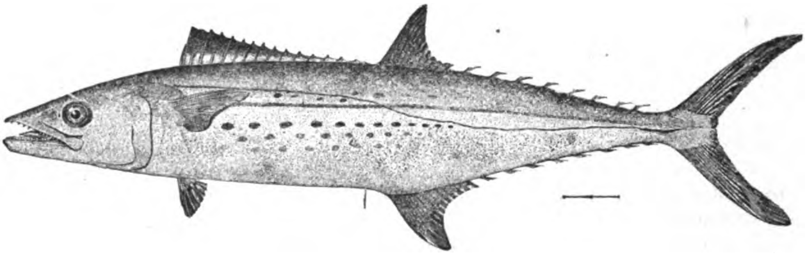

FIG. 28.—*Scomberomorus regalis.*

82. **Scomberomorus cavalla** (Cuvier & Valenciennes). *King-fish; Cero; Cavalla; Sierra.*

Head 5; depth 6; eye large; 2 in snout. D. xv–i, 15–viii; A. ii, 15–viii. Mouth large, maxillary reaching to below eye. Lateral line descending abruptly below second dorsal. Teeth triangular, strongly compressed, about 30 on each jaw. Pectoral 5 in body. Gillrakers very short; less than one-third diameter of eye, about 8 below angle.

Adult iron-gray, nearly or quite immaculate; young with sides of body marked with darker yellowish spots; spinous dorsal without black blotch anteriorly.

Found in the tropical Atlantic, in the open seas, coming in immense numbers to Florida Keys and Charleston, ranging north to Cape Cod and south to Africa and Brazil; very common on our south Atlantic coast, especially among the Florida Keys, the catch at Key West very large. One of the best food-fishes of the Florida coast. Its flesh is firm and of excellent flavor. It usually appears in large numbers from November until April, when it is caught by trolling. The usual weight is about 10 pounds, sometimes reaching 50 pounds. The largest of which there is any record dressed 52 pounds, and 40 pounds is not an unusual weight. Said to school at spawning time, which is believed to be late in the winter.

According to Mr. William H. Abbott, who studied the fisheries in 1891, the average weight of king-fish, as caught by the fishermen of Key West, is about 6 pounds. The larger, weighing from 15 pounds upward, are never as abundant as those weighing under 15. When the fisherman desires to catch large king-fish, he directs his course to the inshore grounds, lying in about 3 fathoms of water and from 1.5 to 3 miles from shore, where the water is muddy; and when small ones are desired, the fishing is done farther offshore along the edge of the Gulf Stream, where the water is much clearer. They are almost invariably found in two separate schools. The Florida spawning-grounds of the king-fish are "down the bay." The first of the winter a great many of the fish have large roes, but it is very seldom that one is taken that has a roe fully matured. If the weather has been very cold in the bay early in the fall, the king-fish will leave before they have spawned, and it is during such seasons that fish containing ripe spawn are most frequently taken.

On the coast of southern Florida, especially off Indian River, Biscayne Bay, and Key West, there is no fish, excepting possibly the tarpon, which affords more sport for the angler than the king-fish, nor is there any to whose season the angler and the commercial fishermen look forward with greater interest and anticipation of pleasure and profit.

Though not obtained by us in Porto Rico it doubtless occurs there, and we include it on the authority of Poey.

Cybium cavalla Cuvier, Règne Animal, ed. 2, II, 200, 1829, Brazil.
Cybium immaculatum Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 191, 1831: no locality given.
Cybium caballa, Poey, Fauna Puerto-Riqueña, 331, 1881.
Scomberomorus cavalla, Jordan & Evermann, l. c., 876, 1896.

Family XXXV. TRICHIURIDÆ. The Cutlas-fishes.

Body extremely elongate, band-shaped, naked, tapering to a point, the ventral fins imperfect or wanting, and the spinous and soft parts of the dorsal fin not differentiated. Mouth wide, jaws armed with strong unequal teeth. Premaxillaries not protractile. Pseudobranchiæ present. Gills 4, a slit behind fourth; gill-membranes separate, free from isthmus; lateral line present. Dorsal fin very long, low, usually continuous, rays all similar. Caudal fin absent; anal fin long and low, scarcely rising above surface of skin. Ventrals thoracic, rudimentary (*Eupleurogrammus*) or wanting. Vertebræ in greatly increased number, about 160. Air-bladder present. Pyloric cœca numerous.

Surface fishes of the tropical seas, comprising 2 genera and about 6 species; very close to the *Lepidopidæ* and *Gempylidæ*, differing from the former chiefly in the absence of a caudal fin, the last stage in the progressive reduction of parts seen in these groups.

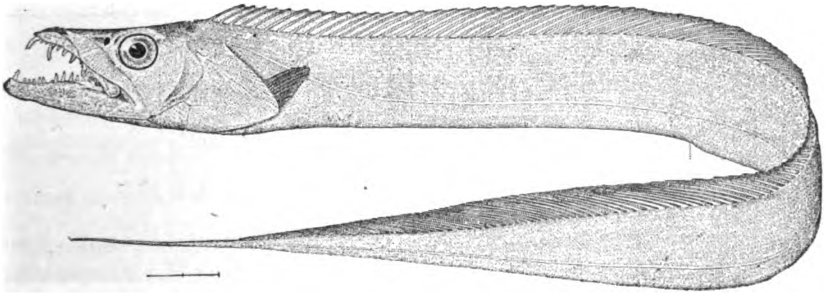

FIG. 29.—*Trichiurus lepturus*.

Genus 52. TRICHIURUS Linnæus. The Hair-tails.

Body extremely elongate, band-like, tail very slender, tapering to a fine point, without caudal fin. Head long, with very wide mouth, jaws armed with unequal and very strong teeth; upper jaw with about four long, strongly compressed barbed teeth; teeth on palatines, none on vomer. Lower jaw the longer, preorbital covering cleft of mouth posteriorly. Dorsal fin single, low, occupying whole of back, spines not distinguishable from soft rays; anal very long, its base more than half length of body; composed of detached spines, which are very short, nearly hidden in skin, anterior directed backward, posterior foward; ventral fins wanting; pectorals small. No scales. Lateral line decurved, concurrent with belly. Vertebræ 39 + 120; ribs excessively frail. Color, silvery.

Voracious fishes of the high seas; reaching a considerable size.

83. Trichiurus lepturus Linnæus. "*Machete*"; *Cutlas-fish; Scabbard-fish; Silver-fish; Sable; Savola.*

Head 8; depth 15.5; eye 6.3 (2.1 in snout); snout 2.8; mandible 1.8; interorbital 6.8; D. about 135; A. about 100. Body scaleless, greatly elongate and compressed, band-like, tail tapering to a fine point, without caudal fin; jaws armed with very strong long teeth, larger ones of upper jaw barbed; lower jaw pointed; projecting preorbital with radiating striæ; dorsal fin as long as back; anal fin of very short embedded spines, anterior directed backward, posterior forward; ventrals wanting. Color, bright silvery.

Found in warm seas, chiefly of the western Atlantic, north to Massachusetts; occasionally in Lower California (Streets); common in the West Indies, swimming near the surface, where it becomes easily benumbed with cold. It is probably not rare about Porto Rico. Two examples, 25 and 15 inches in length, were collected at Palo Seco and Mayaguez.

Trichiurus lepturus Linn., Syst. Nat., ed. X, 246, 1758, America; after *Lepturus* of Artedi; Jordan & Evermann, l. c., 889, 1896. *Lepturus lepturus*, Poey, Fauna Puerto-Riqueña, 333, 1881; Stahl, l. c., 162, 1883.

Family XXXVI. CARANGIDÆ. The Pampanos or Pompanos.

Body more or less compressed and often elevated, sometimes naked, or more usually covered with small, thin, cycloid scales. Head compressed, occipital keel prominent, usually trenchant. Mouth of varying size, dentition various, teeth generally small; premaxillaries usually protractile; maxillary with or without a supplemental bone; preopercle usually entire in adult, in the very young armed with three or more spines. Lateral line complete, anteriorly arched, posterior part straight, sometimes armed with bony plates. Dorsal fins more or less separated, the spinous part rather weak, the spines usually depressible in a groove; anal fin long, similar to soft dorsal, always preceded by two stiff spines, usually separate, but in young often more or less connected with fin or with each other, these sometimes disappear with old age, and sometimes the spinous dorsal also vanishes; often a procumbent spine before dorsal fin; ventral fins thoracic, well developed, I, 5; caudal peduncle very slender, fin widely forked; pectoral fins narrow. Gill-openings very wide, membranes usually not united, free from isthmus. Gills 4, a slit behind last. Gillrakers usually long. Branchiostegals commonly 7. Air-bladder present, often bifurcate behind. Pseudobranchiæ large, present in all our genera, sometimes disappearing with age. Œsophagus unarmed. Pyloric cæca generally numerous. Vertebræ fewer than in the *Scombridæ*, usually $10 + 14 = 24$ in number. First superior pharyngeal without teeth; second, third, and fourth separate, with teeth; lower pharyngeals separate.

Coloration generally metallic and silvery or golden.

The *Carangidæ* include 29 genera and about 200 species, abounding in warm seas, often moving northward in summer, like the *Scombridæ*. They swim swiftly, often with the dorsal fin above the surface of the water. Most of the species are widely distributed, and nearly all are valued as food.

SCOMBROIDINÆ:
a. Premaxillaries not protractile (except in very young). Pectoral fins short, rounded; soft dorsal similar to anal, each much longer than abdomen; lateral line unarmed.
b. Maxillary without supplemental bone; no pterygoid teeth; scales linear, embedded .... OLIGOPLITES, 53
aa. Premaxillaries protractile.
SERIOLINÆ:
c. Anal fin much shorter than soft dorsal, its base not longer than abdomen; pectoral fin short, not falcate; maxillary with a distinct supplemental bone.
d. Dorsal spines low and weak.
e. Dorsal and anal fins without finlets.
f. Membrane of dorsal spines disappearing with age .... NAUCRATES
ff. Membrane of dorsal spines persistent .... SERIOLA, 54
ee. Dorsal and anal fins each with a detached two-rayed finlet .... ELAGATIS
cc. Anal fin about as long as soft dorsal, its base longer than abdomen.
g. Maxillary with a supplemental bone; lateral line arched anteriorly, usually armed posteriorly; pectoral long, falcate.
CARANGINÆ:
h. Dorsal outline more strongly curved than ventral outline.
i. Dorsal and anal each with a single detached finlet; body slender .... DECAPTERUS, 55
ii. Dorsal and anal without finlets.
j. Lateral line with well-developed scutes for its entire length; body elongate .... TRACHURUS
jj. Lateral line with scutes on its straight posterior portion only (these sometimes very few and small, especially in those species with body much compressed).
k. Shoulder-girdle with deep cross-furrow at its junction with isthmus, above which is a fleshy projection; body elongate .... TRACHUROPS, 56
kk. Shoulder-girdle normal, its surface even; body deeper.
l. Body oblong or more or less elevated, not as below.
m. Teeth of jaws in few series or in one series, unequal, or at least not forming villiform bands, outer series above usually enlarged, lower teeth usually uniserial.
n. Maxillary very narrow, its greatest width scarcely one-fourth eye; head small, lateral line strongly arched in front; teeth uniserial, those on palatines and vomer minute or obsolete .... HEMICARANX
nn. Maxillary broad; head rather large; vomer and palatines with teeth .... CARANX, 57

mm. Teeth of jaws equally small or wanting, forming villiform bands if present; maxillary broad; body compressed; spinous dorsal weak, usually disappearing with age.

o. Soft dorsal lobe very high, filamentous .... ALECTIS

oo. Soft dorsal lobe low .... HYNNIS

ll. Body broad-ovate, very strongly compressed, its outlines everywhere trenchant, anterior profile nearly vertical; scutes almost obsolete .... VOMER, 58

jjj. Lateral line without any scutes; body short and elevated, strongly compressed .... SELENE, 59

CHLOROSCOMBRINÆ:

hh. Dorsal outline less strongly curved than ventral; body much compressed, its outlines everywhere trenchant; armature of lateral line obsolete, or nearly so .... CHLOROSCOMBRUS, 60

TRACHINOTINÆ:

gg. Maxillary without supplemental bone; anal fin similar to soft dorsal, its base much longer than abdomen; tail unarmed; pectoral short, not falcate.

p. Forehead convex; teeth small or deciduous .... TRACHINOTUS, 61

Genus 53. OLIGOPLITES Gill. Leather-jackets.

Body compressed, oblong or lanceolate. Caudal peduncle slender, not keeled. Head short, compressed, acute. Occipital keel sharp. Mouth rather large, with small sharp teeth in bands on jaws, tongue, vomer, and palatines, none on pterygoids. Jaws about equal, upper not protractile, except in very young, in which it is movable as in other *Carangidæ;* maxillary very narrow, without distinct supplemental bone. Gillrakers rather long. Scales small, linear, and extremely narrow, embedded in skin at different angles. Lateral line unarmed. Dorsal spines rather strong, 3 to 5 in number, nearly free in adult; second dorsal very long, its posterior rays pencillated and nearly or quite disconnected, forming finlets; anal rather longer than soft dorsal, much longer than abdomen, its last rays forming similar finlets; anal spines strong; ventral fins depressible in a groove; pectoral fins very short.

Species few, occurring in the tropical seas of America.

a. Maxillary not reaching posterior border of eye; lowest infraorbital bone usually narrower than one above it. *saurus*, 84

aa. Maxillary reaching beyond posterior border of eye; lowest infraorbital bone usually broader than one next above it. *saliens*

84. Oligoplites saurus (Bloch & Schneider). "*Zapatero*"; *Quiebra; Runner; Leather-jack.*

(PLATE 7.)

Head 4.8; depth 3.75; eye 3.6; snout 3.25; maxillary 1.9; mandible 1.7; interorbital 3; D. V–I, 20; A. II–I, 20; pectoral 1.7; ventral 1.9; caudal 1.

Body elongate, lanceolate, and much compressed; back gently elevated; caudal peduncle very slender, somewhat higher than thick; head small and pointed; anterior profile slightly concave in occipital region; mouth wide, maxillary reaching nearly to posterior border of eye, jaws subequal or lower very slightly projecting; villiform teeth on vomer, palatines, and tongue; bands of larger teeth in jaws; head naked, body covered with very narrow, linear, embedded scales, placed at various angles, making a tough leathery integument; fins small, dorsal spines nearly free, soft dorsal and anal long and low, anterior rays somewhat elevated, others expanded and nearly disconnected from each other, forming finlets, as in the mackerel; ventrals depressible in a groove; caudal widely forked.

Color, blue above, silvery below, the demarcation fairly abrupt, corresponding with a line from anterior end of lateral line to base of upper caudal lobe; fins yellow.

The zapatero inhabits both coasts of tropical America, extends north to New York and Lower California, and is very common in the West Indies and along the coast of Florida. It is a very graceful and handsome species, very common, often leaping from the water. It is not much valued as food, being dry and bony. Forty-two, from 2.25 to 10.5 inches in length, were taken at Palo Seco, Mayaguez, Ponce, Hucares, and Fajardo; one at San Geronimo.

Scomber saurus Bloch & Schneider, Syst. Ichth., 321, 1801, Jamaica.
Centronotus argenteus Lacépède, Hist. Nat. Poiss., III, 316, 1802, Equatorial America.
Lichia quiebra Quoy & Gaimard, Voyage Freycinet, Zool., 365, 1824, Equatorial America.
Chorinemus saltans Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 393, 1831, Martinique, Brazil, and Santo Domingo.
Ologoplites inornatus Gill, Proc. Ac. Nat. Sci. Phila. 1863, 166, Panama.
Oligoplites occidentalis, Poey, Fauna Puerto-Riqueña, 332, 1881; Stahl, l. c., 77 and 163, 1883.
Oligoplites saurus, Jordan & Evermann, l. c., 898, 1896.

Genus 54. SERIOLA Cuvier. The Amber-fishes.

Body oblong, moderately compressed, not elevated. Occiput and breast not trenchant. Head usually more or less conical, not very blunt. Mouth comparatively large, with broad bands of villiform teeth on both jaws, tongue, vomer, and palatines; a broad, strong, supplemental maxillary bone; premaxillaries protractile. Scales small; lateral line scarcely arched, forming a keel on caudal peduncle, not armed with bony plates; sides of head with small scales. First dorsal with about 7 low spines, connected by membrane; second dorsal very long, elevated in front; anal similar to soft dorsal but not nearly so long, shorter than abdomen, preceded by 2 very small free spines, which disappear in old fishes; no finlets; ventral fins very long; pectoral short and broad. Gillrakers moderate.

Species of moderate or large size, often gracefully colored; most of them valued as food-fishes.

SERIOLA:
- *a.* Head longer than deep, profile not very steep. Dorsal and anal fins not falcate, height of their lobes less than half depth of body. Dorsal rays 30 to 38; species of large size, elongate, with 5 or 6 broad, dark crossbars when young, these becoming obsolete with age; a yellow lateral band; nuchal bar pale.
  - *b.* Dorsal rays 36 to 38; dark bands on young very broad .... *zonata*
  - *bb.* Dorsal rays 30 to 34. Mouth rather large, maxillary reaching middle of pupil; dark bands on young broad.
    - *c.* Body slender, depth 3.5 to 3.75 in length .... *lalandi*
    - *cc.* Body deeper, depth 3 in length .... *dumerili*

ZONICHTHYS:
- *aa.* Head deeper than long, anterior profile steep; no yellow longitudinal band; size small.
  - *d.* Dorsal not falcate, its soft rays 32; young with about 12 narrow dark crossbars .... *fasciata*
  - *dd.* Dorsal and anal falcate, their anterior lobes more than half depth of body; head deeper than long; body deep; dorsal rays 27 to 30.
    - *e.* Nuchal band dark-brown or black .... *rivoliana*
    - *ee.* Nuchal band pale-yellowish .... *falcata*, 85

85. **Seriola falcata** Cuvier & Valenciennes. *Madregal; Rock Salmon.*

Head 3.8 (4.6 in total); depth 3.4 (4 in total). D. VII–I, 29; A. II–I, 21. Cæca 30. Body rather deep and compressed. Head somewhat longer than deep, not conical. Snout 2.75 in head; maxillary reaching front of pupil, 3.5 in head, its tip broad; eye large, 5.25 in head, 1.75 in snout. Occiput somewhat carinated. Interorbital space wide, convex. Caudal keel little developed. Dorsal high, somewhat falcate, its anterior lobe 1.4 in head, 2.33 in base of fin; pectoral 2 in head; ventrals 1.6; anal lobe 1.75; anal spines small.

Life coloration as follows: Grayish above, paler but hardly silvery below; fins blackish, pectoral pale; caudal not at all yellow; eye white; lining of opercle pale; a very obscure olivaceous band from eye to front of dorsal, scarcely visible in fresh specimens; preorbital and preopercle shaded with olive.

Found in the West Indies, north to Florida and the Carolinas. Not seen by us in Porto Rico, but included on the authority of Valenciennes and Poey.

Seriola falcata Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 210, pl. 515, 1833, Porto Rico, Jamaica, and Mexico: Poey, Fauna Puerto-Riqueña, 332, 1881; Jordan & Evermann, l. c., 905, 1896.
Seriola dubia Lowe, Proc. Zool. Soc. Lond., VII, 1839, 81, Madeira.
Seriola declivis Poey, Memorias, II, 230, 1860, Havana.
Seriola ligulata Poey, Memorias, II, 231, 1860, Cuba.

Genus 55. DECAPTERUS Bleeker. The Mackerel Scads.

Body elongate, little compressed, almost perfectly fusiform. Head short, pointed. Mouth rather small; jaws about equal, the dentition feeble; maxillary rather broad, with a supplementary bone. Premaxillaries protractile. Scales moderate, enlarged for the whole length of lateral line, but spinous and bony posteriorly only; second dorsal and anal each with a single detached finlet; free anal spines very strong; first dorsal well developed, persistent; pectoral comparatively short. Abdomen rather shorter than anal fin. Gillrakers long and slender.

Species numerous; only one known to occur in Porto Rico.

- *a.* Shields of lateral line numerous, 40 to 50 in number .... *punctatus*, 86
- *aa.* Shields of lateral line few, 20 to 30 in number.
  - *b.* Teeth minute on both jaws, vomer, palatines, and tongue; shields 22 to 28; depth 5 in length .... *sanctæ-helenæ*
  - *bb.* Teeth obsolete; caudal keel of 25 shields; depth 5.75 in length .... *macarellus*

86. **Decapterus punctatus** (Agassiz). *Scad; Round Robin; Cigar-fish; Quia-quia.*

(PLATE 8.)

Head 4; depth 5.6; eye 3.3; snout 3; maxillary 3; mandible 2.3; interorbital 3.5; D. VIII-I, 30-I; A. II-I, 27-I; pectoral 1.4; ventral 2.1; caudal 1.7; scutes 39.

Body elongate, fusiform, scarcely compressed at all; caudal peduncle very short and slender; head small and pointed; jaws subequal, maxillary reaching front of eye; teeth of jaws weak, uniserial; adipose eyelid as in *T. crumenophthalmus*, but not covering so much of eye; lateral line scarcely arched, posterior portion with large rather sharply armed scutes, anterior with a series of ordinary scales which are not as easily deciduous as others. Shoulder-girdle with a small papilla of the integument (seen by raising gill-covers), somewhat similar to that in *T. crumenophthalmus*, but much smaller and higher in position. This species resembles the latter, but is readily recognized by the presence of the single detached finlet at end of soft dorsal and anal fins.

Color, bluish above, silvery below, with a dark opercular spot, its edge extending upon shoulder.

The scad ranges from Cape Cod to Brazil, but is only occasional northward. It is common on the coasts of Florida and in the West Indies. Nine examples collected, three of them each about 6½ inches in length, taken in the seine by native fishermen at Aguadilla, where, with *T. crumenophthalmus*, it was the principal part of the catch; the other six are the young, about 2 inches in length, taken in 220 fathoms, 9 miles from Mayaguez, by the beam-trawl. The species is commonly used as food.

Caranx punctatus Agassiz, Spix, Pisc. Bras., 108, 1829, Brazil.
Caranx suareus Risso in Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 33, 1833, Mediterranean.
Decapterus punctatus, Jordan & Evermann, l. c., 907, 1896.

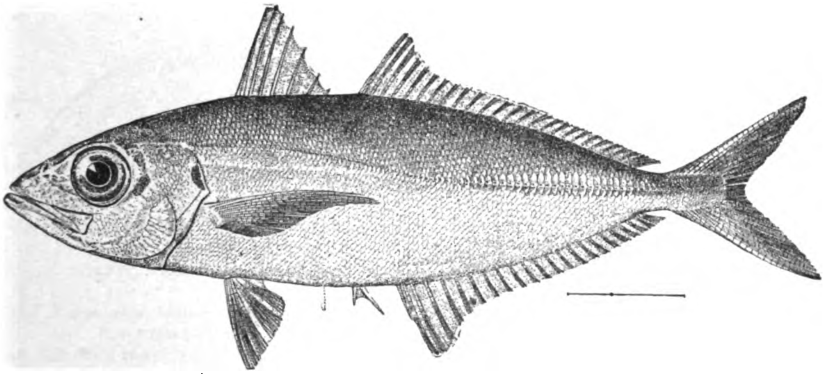

FIG. 30.—*Trachurops crumenophthalmus.*

Genus 56. TRACHUROPS Gill.

This genus is close to *Caranx*, differing in the more elongate form and especially in the structure of the shoulder-girdle, which has a deep cross-furrow at its junction with the isthmus, with a fleshy projection above the furrow. Species few, found in all warm seas.

87. **Trachurops crumenophthalmus** (Bloch). *Goggler; Big-eyed Scad; Goggle-eye Jack; Chicharro.*

Head 3.2; depth 3.8; eye 3.2; snout 2.9; maxillary 2.5; mandible 2; interorbital 4.4; D. VIII-I, 25 or 26; A. II-I, 22; pectoral 1.2; ventral 2.1; scutes 35.

Body elongate; but little compressed; back not elevated; dorsal outline little curved; caudal peduncle subcylindrical, very slender and short; head rather large and pointed; mouth large, lower jaw projecting; teeth on vomer, palatines, tongue, and jaws all weak, uniserial on jaws; maxillary reaching about to front of pupil; eye very large, with an adipose eyelid covering two-thirds of eye, leaving a vertical elliptical area exposed opposite pupil; lateral line slightly arched anteriorly, covered posteriorly with large weak scutes, their spines not strong nor sharp; pectoral falcate; ventral small; soft dorsal and anal long and low, their anterior rays somewhat elevated; caudal widely forked. Just above junction of isthmus with shoulder-girdle is a large fleshy nipple-like projection.

Color, bluish above, silvery below; a faint dark opercular blotch; no striking colors.

This species reaches a length of 2 feet, and is found on both coasts of tropical America and in tropical seas generally. Common about Porto Rico; 38 examples, from 4 to 9 inches, collected at Palo Seco, Aguadilla, and Culebra; one from San Geronimo.

Scomber crumenophthalmus Bloch, Ichthyologia, pl. 343, 1793, Acara in Guinea.
Scomber plumieri Bloch, Ichthyologia, pl. 344, 1793, Antilles.
Scomber balantiophthalmus Bloch & Schneider, Syst. Ichth., 29, 1801, Guinea.
Caranx macrophthalmus Agassiz in Spix, Pisc. Bras., 107, 1829, Brazil.
Trachurops brachychirus Gill, Proc. Ac. Nat. Sci. Phila. 1862, 261, Cape San Lucas.
Trachurops crumenophthalmus, Poey, Fauna Puerto-Riqueña, 331, 1881; Jordan & Evermann, l. c., 911, 1896.
Trachurops plumieri, Stahl, l. c., 77 and 163, 1883.

Genus 57. CARANX Lacépède. The Crevallés.

Body ovate or oblong, compressed; back sometimes considerably elevated, sometimes little arched. Head moderate or rather large, more or less compressed. Mouth moderate or large, oblique; maxillary broad, with a well-developed supplemental bone, extending to below eye. Premaxillaries protractile. Teeth developed in one or few series, unequal, or at least not in villiform bands. Villiform teeth usually present on vomer, palatines, and tongue, wanting or deciduous in some species. Gillrakers long. Eye large, with adipose eyelid. Dorsal spines rather low, connected; second dorsal long, usually elevated in front, both fins depressible in a groove. Anal fin similar to second dorsal and nearly as long, preceded by two rather strong spines, its base longer than abdomen. Caudal fin strongly forked, peduncle very slender. Ventral fins moderate; pectorals falcate; no finlets. Scales present, mostly very small. Lateral line with its posterior portion armed with strong bony plates, which grow larger on tail, each plate armed with a spine; a short dorsal branch of lateral line usually present. Preopercle entire in adult, serrate in young, usually with a membranous border.

Species very numerous, in all warm seas, most of them valued for food.

a. Teeth on vomer and palatines persistent.
  b. Soft dorsal and anal low, not much elevated in front, little if at all falcate; teeth in jaws in one or few series, with no canines.
    c. Body slender, depth about 3.5 in length; color dark, chiefly bluish .... *ruber*, 88
    cc. Body deeper, depth about 2.8 in length; color pale, mostly golden .... *bartholomæi*, 89
  bb. Soft dorsal and anal much elevated in front and more or less falcate; upper teeth in a band, outer enlarged; lower teeth in one series; dorsal sheath of scales not greatly developed; soft dorsal and anal both rather short.
    d. Breast naked, except a small rhombic area before ventrals; two small canines in front of lower jaw; body robust, compressed.
      e. Opercular spot large; adult with a black spot on pectoral; pectoral 3 in length .... *hippos*, 90
    dd. Breast entirely covered with small scales.
      f. Body subfusiform, depth less than one-third the length; breast scaly; teeth of outer series small, not canine-like; a black opercular spot; no spot on pectoral; arch of lateral line about half straight part .... *crysos*, 91
      ff. Body oblong-ovate, depth more than one-third length; outer teeth rather strong, lower teeth not canine-like.
        g. General color silvery; vertical fins not all black .... *latus*, 92
        gg. General color brassy or blackish; vertical fins black; lower teeth not canine-like .... *lugubris*

URASPIS:

aa. Teeth on vomer and palatines wanting or deciduous; teeth in jaw subequal, bluntish, in one or two rows; lateral line not strongly arched; soft dorsal and anal low; shields rather few.
  h. Body deep, compressed, back and belly arched; shields 24 to 30; second dorsal I, 26; anal I, 22; opercular spot present .... *guara*

88. **Caranx ruber** (Bloch). *Cibi Mancho; Carbonero.*

Head 3.5; depth 3.5; eye 5.4; snout 2.6; maxillary 2.6; mandible 2.25; interorbital 3; preorbital 9; D. VIII–I, 26; A. II–I, 23; pectoral 1; ventral 2.8; caudal 1.1; scutes about 30.

Body elongate, back scarcely elevated, caudal peduncle slender, much wider than deep, scutes forming a very strong keel; head pointed, symmetrical; maxillary nearly or quite reaching front of eye; teeth on vomer, palatines, tongue, and jaws, in villiform bands; no enlarged teeth; arch of lateral line moderate, somewhat shorter than straight part, which is about 2.5 in body; pectoral falcate, with very slender tip, reaching anal; anterior rays of soft dorsal and anal somewhat produced, those of dorsal 2.3 in head, of anal 2.7; caudal widely forked.

Color in spirits: Bluish above, pale on sides and below; parts of head with golden wash; lower lobe of caudal with a wide dusky lengthwise bar; dorsal somewhat dusky, other fins nearly pale.

West Indies. Four specimens, 6.5 to 14 inches in length, from Mayaguez, Ponce, and Culebra, taken in the seine. One of 5 inches from San Geronimo we refer with some doubt to this species.

Scomber ruber Bloch, Ichthyologia, pl. 342, 1793, St. Croix.
Caranx blochii Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 69, 1833, St. Croix.
Caranx iridinus Poey, Memorias, II, 226, 1860, Cuba.
Caranx ruber, Jordan & Evermann, l. c., 919, 1896.

89. Caranx bartholomæi (Cuvier & Valenciennes). *Yellow Jack; Cibi Amarillo.*

Head 3.3; depth 2.8; eye 4.8; snout 2.8; maxillary 2.4; mandible 2.1; interorbital 3; preorbital 8; D. VIII–I, 26; A. II–I, 22; pectoral 1; ventral 2.6; caudal 1.1; about 30 scutes. Close to *C. ruber*, but the body not so slender, and straight portion of lateral line longer, nearly as long as curved part, 2.8 in body; maxillary reaching past front of eye.

Bluish above, a golden wash everywhere.

West Indies, north to Florida and the Carolinas; common in Cuba, but not very common in Porto Rico. One specimen, 9.5 inches long, from San Juan market.

Caranx bartholomæi Cuv. & Val., Hist. Nat. Poiss., IX, 100, 1833, St. Bartholomew; Jordan & Evermann, l. c., 919, 1896.
Caranx cibi Poey, Memorias, II, 224, 1860, Cuba.
Caranx beani Jordan, Proc. U. S. N. M. 1880, 486, Beaufort, N. C.

90. Caranx hippos (Linnæus). *Crevallé; Toro; Horse Crevallé; Cavally; Jack; Jiguagua.*

Head 3; depth 2.5; eye 3.8; snout 3.4; maxillary 2.3; mandible 2; interorbital 3.7; D. VIII–I, 20; A. II–I, 17; pectoral 1; ventral 2.3; caudal 1.1; scutes about 30.

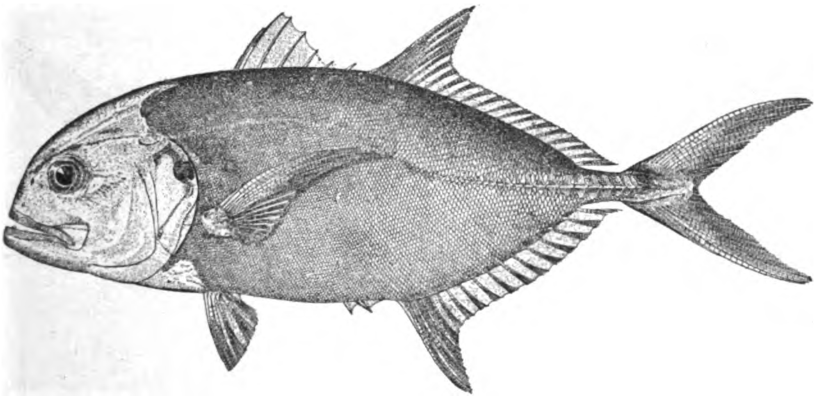

FIG. 31.—*Caranx hippos.*

Body not greatly elongate, anterior profile very strongly arched, approximating vertical from front of eye to tip of snout in adult; mouth nearly horizontal, low; maxillary reaching posterior border of eye in adult, middle of eye in 5-inch individuals; teeth of upper jaw in a villiform band, with an outer row of considerably enlarged teeth, rather wide-set; one row of teeth in lower jaw, a pair of canines at symphysis; lateral line with a rather strong arch, shorter than straight part; breast naked, except a patch in front of ventrals. A large, very distinct jet-black spot on opercle; a fainter black spot on lower rays of pectoral, often wanting in young; axil of pectoral black; lobe of soft dorsal and upper surface of caudal peduncle dusky.

The most strongly marked of the species of *Caranx*, known at once from the strong arch of the head, the naked breast, and the opercular and pectoral spots. The collection contains only the young, 2.75 to 5.5 inches long, from Palo Seco. It does not appear to be common in Porto Rico, though it is of wide distribution, being found in all warm seas and generally abundant. It occurs on both coasts of tropical America and ranges as far north as Cape Cod and the Gulf of California. It bites voraciously and affords much sport to the angler, who takes it by trolling. It is taken at Key West both by trolling and by bottom fishing. It is very ravenous, swimming with great swiftness, and preying upon smaller fishes. It is said to attain a weight of 20 pounds, but those caught in Indian River, Florida, do not average over 3 pounds. As a food-fish it does not occupy a high rank. It was not seen in any of the Porto Rican markets, which, however, was probably due to its scarcity at that particular season.

Scomber hippos Linnæus, Syst. Nat., ed. XII, 494, 1766, Charleston, S. C.
Scomber carangus Bloch, Ichth., pl. 340, 1793, Antilles.
Caranx erythrurus Lacépède, Hist. Nat. Poiss., III, 68, 1802, South Carolina.
Caranx carangua Lacépède, Hist. Nat. Poiss., III, 59 and 74, 1802, Martinique; on a drawing by Plumier.
Caranx daubentonti Lacépède, Hist. Nat. Poiss., III, 72, 1802, Martinique; on a drawing by Plumier.
Caranx xanthopigus Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 109, 1833, Isle de France.
Caranx ekala Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 117, 1833, Vizagapatam.
Caranx antillarum Bennett, Whaling Voyage, II, 282, 1840, West Indies.
Caranx defensor De Kay, New York Fauna; Fishes, 120, 1842, New York.
Carangus esculentus Girard, U. S. Mex. Bound. Surv., 23, pl. 11, figs. 1–3, 1859, Brazos Santiago, Texas.
Caranx caninus Günther, Fishes Centr. Amer., 432, 1869, Panama.
Caranx hippos, Jordan & Evermann, l. c., 920, 1896.

91. **Caranx crysos** (Mitchill). "*Cojinuda*"; *Hard-tail; Runner; Jurel; Yellow Mackerel; Crevalle.*

(PLATE 9.)

Head 3.5; depth 3.2; eye 5.6; snout 3; maxillary 2.4; mandible 2.1; interorbital 3; preorbital 11; D. viii–i, 24; A. ii–i, 20; pectoral 0.8; ventral 2.3; caudal 0.95; about 45 scutes.

Body elongate, slightly elevated, not greatly compressed; maxillary reaching front of pupil or middle of eye; teeth in jaws conical and sharp, not very close-set, in one series in lower jaw, in two in upper, inner series of smaller teeth; no canines; lateral line more strongly arched anteriorly than in *C. ruber* or *C. bartholomæi*, arch rather more than half straight part; pectoral long and falcate, reaching anal or slightly beyond; anterior rays of soft dorsal and anal elevated and falcate. A distinct black blotch on opercle.

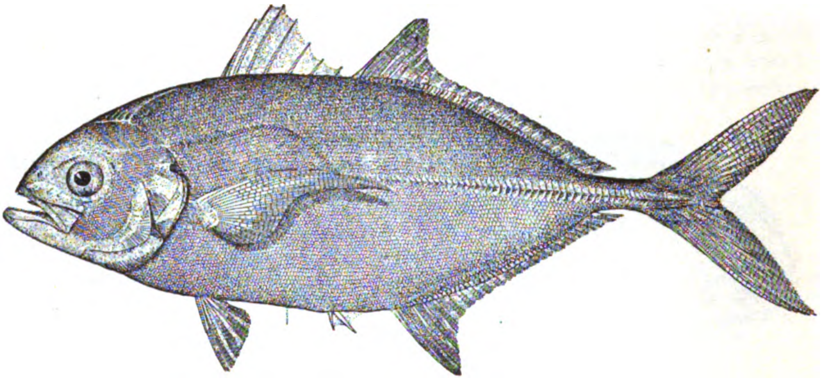

FIG. 32.—*Caranx crysos.*

This species is found from Cape Cod to Brazil, is generally abundant, and is common farther to the north than any other of the species of *Caranx*. It is an important and well-known food-fish, fairly common. In Porto Rico only two specimens were collected, one 10.5 inches long from San Antonio Bridge, and one 17.5 inches long, which was taken on the hook at Isabel Segunda, displaying good game qualities. This is one of the best game-fishes of Porto Rico and can be taken by either still-fishing or trolling.

Scomber crysos Mitchill, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 424, New York.
Caranx pisquctus Cuvier & Valenciennes, Hist, Nat. Poiss., IX, 97, 1833, Santo Domingo, Cuba, and Brazil.
Trachurus squamosus Gronow, Cat. Fishes, ed. Gray, 125, 1854, Carolina.
Paratractus chrysos, Stahl, l. c., 77 and 163, 1883.
Caranx crysos, Jordan & Evermann, l. c., 921, 1896.

92. **Caranx latus** Agassiz. "*Jurel*"; *Xurel; Horse-eye Jack.*

Head 3.35; depth 2.7; eye 4; snout 3.5; maxillary 2.1; mandible 1.8; interorbital 3.2; D. viii–i, 22; A. ii–i, 18; pectoral 0.95; ventral 2.1; caudal 1.1; about 35 scutes. Form of *C. hippos*, but with anterior profile not quite so strongly arched, breast scaled; axillary and pectoral spots absent; opercular spot not so large nor distinct, scutes somewhat greater in number; adipose eyelid moderately developed; maxillary reaching past middle of eye.

Lobe of dorsal dusky, that of anal golden; the young with 4 or 5 dark vertical bars and a faint opercular spot, these sometimes absent; opercular spot is larger, deeper in color, and more persistent in young of *C. hippos*, and usually serves to separate readily small individuals of the two species.

C. latus is a very widely distributed species, occurring in all tropical seas, and very abundant in the West Indies, and by far the commonest species of *Caranx* in Porto Rico. The collection contains 137 specimens, varying in size from 3 to 9.5 inches. The poisonous character sometimes attributed to its flesh evidently does not attach to it in Porto Rico, where it may be found for sale in the markets. Our specimens were collected at Palo Seco, San Antonio Bridge, Aguadilla, Mayaguez, Culebra, Isabel Segunda, and Fajardo. Mr. Gray took two at San Geronimo.

Caranx latus Agassiz, Pisc. Bras., 105, 1829, Brazil; Jordan & Evermann, l. c., 923, 1896.
Caranx lepturus Agassiz, Pisc. Bras., 106, 1829, Brazil.
Scomber heberi Bennett, Fishes Ceylon, pl. 26, 1830, Ceylon.
Caranx fallax Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 95, 1833, Antilles: Brazil.
Caranx sen Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 105, 1833, Pondicherry.
Caranx forsteri Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 107, 1833, East Indies.
Caranx peroni Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 112, 1833, East Indies.
Caranx lessoni Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 113, 1833, Malabar.
Caranx belengeri Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 116, 1833, Malabar.
Caranx paraspistes Richardson, Voyage Erebus and Terror, 136, 1844, Port Essington.
Caranx richardi Holbrook, Ichth. South Carolina, 96, pl. 13, fig. 1, 1860, South Carolina.
Caranx aureus Poey, Enumeratio, 76, 1875, Cuba.
Carangus fallax, Poey, Fauna Puerto-Riqueña, 331, 1881; Stahl, l. c., 77 and 163, 1883.

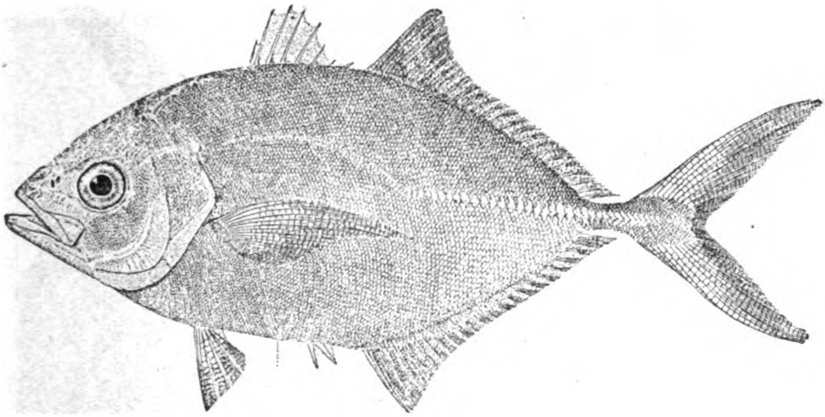

FIG. 83.—*Caranx latus*.

Genus 58. VOMER Cuvier & Valenciennes.

This genus is closely allied to *Caranx*, from which it differs only in its distortion of form, and in its weak teeth and very low fins. Body broad-ovate, very strongly compressed, all the outlines sharply trenchant. Head very gibbous above eyes, its anterior profile vertical; lateral line strongly arched, its posterior portion with very weak shields. Scales minute, rudimentary; the soft dorsal and anal extremely low, not falcate. Young much deeper in form than adult, all the fins higher, resembling *Selene*. Found in the warm seas.

a. Soft dorsal with about 25 rays; depth in adult less than half length .... *dorsalis*
aa. Soft dorsal with 21 or 22 rays.
b. Depth in adult about half length .... *setipinnis*
bb. Depth in adult much more than half length .... *gabonensis*, 93

93. Vomer gabonensis Guichenot. "*Corcobado.*"

Head 2.75; depth 1.5; eye 3.8; snout 2.2; maxillary 2.5; mandible 2.2; interorbital 4.2; preorbital 2.6; D. VIII-I, 22; A. I, 18; pectoral 1; caudal 1.1; scales minute.

Body ovate, scarcely longer than deep, very greatly compressed; occipital region greatly elevated, making height of body greatest above eye; anterior profile nearly vertical from occiput to eye, opposite which it becomes concave; snout protruding; mouth oblique, maxillary extending opposite nostrils, not reaching front of eye; lower jaw entering profile; a single row of numerous weak teeth in each jaw; preorbital very broad; spinous dorsal weak, first four spines comparatively long, second about half diameter of eye, very slender, weak, and flexible, next four much shorter, stiff, pungent, and partially embedded; soft dorsal long and low, anterior rays somewhat elevated, not falcate; anal similar to soft dorsal, its rays somewhat more widely set, first one or two a little elevated; pectoral falcate, as long as head, reaching past middle of anal; ventrals minute, caudal peduncle short and very slender, the fin widely forked, its lobes equal; head and upper parts of body naked, minute persistent scales below; lateral line with minute rudimentary scutes on its straight portion, anterior part strongly arched, its chord a little shorter than straight part.

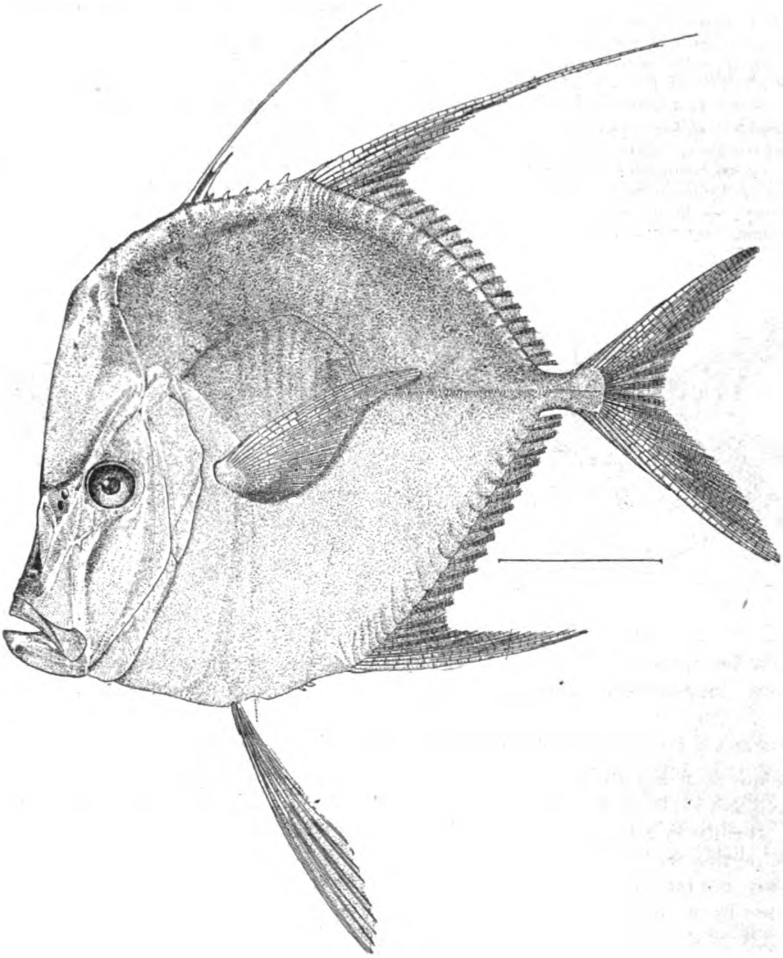

FIG. 34.—*Selene vomer*. Young.

Color in life: Rich silvery with an iridescence of steel-blue above and of pink below, with a light golden wash on lower parts.

This species seems to be the common *Vomer* of Porto Rico and distinct from *V. setipinnis*, which does not appear in our collection. It may be separated from the latter form by the much deeper body, larger eye, greater elevation of occipital region, and more nearly vertical anterior profile. The young of the two species resemble each other more closely. At a length of about 4 inches the difference between them in relation of depth to length becomes apparent, but before that size is attained *V. gabon-*

ensis may be distinguished by its larger eye, at least in some individuals of 2 or 3 inches in length. The ventral outline of *V. setipinnis* is somewhat more strongly curved than in *V. gabonensis*, while in the adult the reverse is true. The young of *V. gabonensis* has the caudal lobes more slender and somewhat longer than in the corresponding size of the other species, but this difference disappears in the adult. The species reaches a weight of a pound or more, is abundant and much used as food, being hawked about the streets upon strings attached to a stick, which is carried over the shoulders.

The corcobado is known from Africa and the West Indies. We collected 32 examples, 2.5 to 8 inches long, from San Juan market, Palo Seco, Arecibo, Aguadilla, Arroyo, and Isabel Segunda.

Argyreiosus setipinnis var., Günther, Cat., II, 459, 1860, Fernando Po, Santo Domingo, Jamaica, and Bahia.
Vomer gabonensis Guichenot, Ann. Soc. Linn. Maine et Loire, 42, 1865, Gaboon; Jordan & Evermann, l. c. 934, 1896.

Genus 59. SELENE Lacépède. The Moon-fishes.

Body very closely compressed and much elevated; profile very oblique or nearly vertical; edges of body everywhere trenchant, especially anteriorly. Head short and very deep, opercle very short, and preorbital extremely deep; an abrupt angle at occipital region. Mouth rather small; premaxillaries protractile, fitting into a notch between the bases of maxillaries; maxillaries broad, each with supplemental bone. Tongue narrow, free. Teeth minute, on jaws, tongue, vomer, and palatines. Gillrakers long and slender. Spines of fins usually weak, more or less filamentous in young; free anal spines immovable, sometimes obsolete in the adult. Soft fins falcate, much elevated. No finlets. Head naked. Scales minute. Lateral line wholly unarmed. Coloration silvery.

Found in the tropical seas. Notwithstanding its extraordinary form this genus differs in no important regard from *Caranx*.

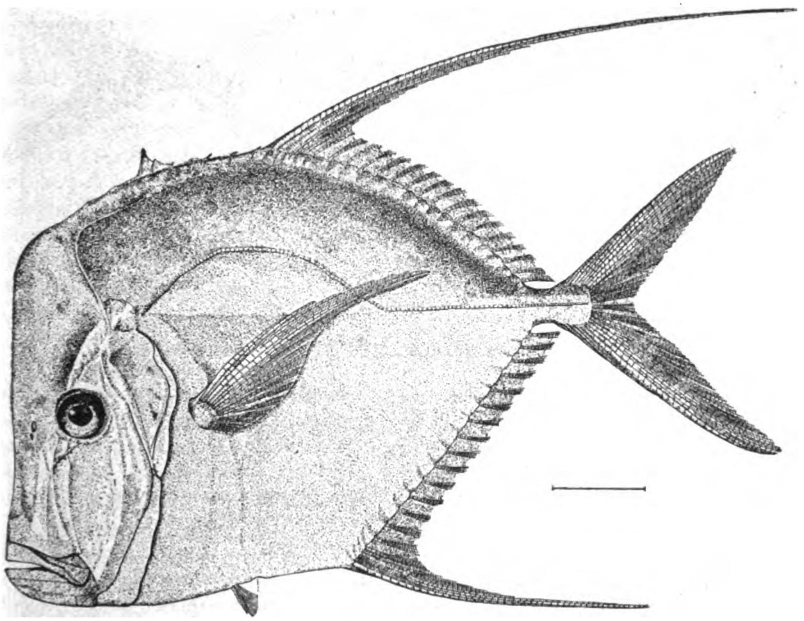

FIG. 35.—*Selene vomer*. Adult.

94. Selene vomer (Linnæus). *Moon-fish; Jorobado; Look-down.*

Head 3; long dorsal rays 2; pectoral 2.75; long anal rays 2.66; depth 1.5, the young much deeper. D. VII–I, 23; A. II–I, 18. Anterior profile from tip of snout to occiput almost perfectly straight in adult. Diameter of eye, length of opercle, and distance from eye to profile about equal; eye 2 in maxillary, 2.5 in preorbital; mandibles very deep, dentary bones thin, approximate; one or two of the dorsal spines greatly elongate and filamentous in young, short in adult; ventrals variable in length, usually about as long as the eye in the adult, variously elongate in partly grown specimens.

Color, uniform silvery in adult.

Our observations of this species tend to confirm the correctness of Dr. Lütken's views (Spolia Atlantica, 139) as to the transformations incident to its growth.

A species of tropical America, occurring on both coasts, from Cape Cod to Brazil, and from Lower California to Peru. Very common southward on sandy shores, both in the Atlantic and Pacific. No specimens were obtained by us, but we include it on the authority of Poey and Stahl. It attains a weight of about 2 pounds and is a delicious pan-fish.

Zeus vomer Linn., Syst. Nat., ed. X, 1758, 266, America; after *Zeus cauda bifurca* of Linnæus, Mus. Adolph-Fred., I, 66.
Zeus gallus Linn., Syst. Nat., ed. X, 1758, 267, America; after *Zeus cauda bifurca* of Artedi; confused with *Alectis ciliaris*.
Zeus capillaris Mitchill, Trans. Lit. & Phil. Soc., 1, 1815, 383 (young), New York.
Zeus rostratus Mitchill, l. c., 384, New York (young).
Zeus geometricus Mitchill, Amer. Monthly Mag., II, 1818, 245 (adult), New York.
Argyriosus triacanthus Swainson, Nat. Hist. Class'n Fish., 250, 1839, Brazil; after Spix & Agassiz, pl. 58 (young).
Argyriosus mauricei Swainson, l. c., 408, Brazil (adult).
Argyriosus mitchilli De Kay, N. Y. Fauna: Fishes, 126, 1842 (young), New York.
Argyriosus brevoorti Gill, Proc. Ac. Nat. Sci. Phila. 1863, 83, Panama (young).
Argyriosus pacificus Lockington, Proc. Ac. Nat. Sci. Phila. 1876, 84. Lower California; adult.
Selene argentea, Poey, Fauna Puerto-Riqueña, 332, 1881; Stahl, l. c., 77 and 164, 1883.
Selene vomer, Jordan & Evermann, l. c., 936, 1896.

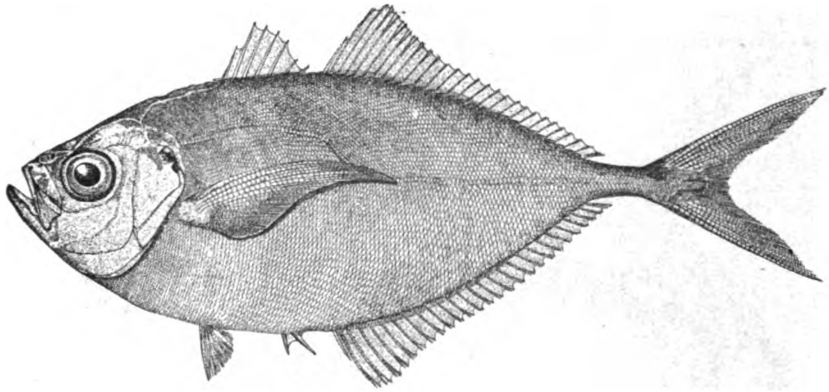

FIG. 36.—*Chloroscombrus chrysurus*.

Genus 60. CHLOROSCOMBRUS Girard. The Casabes.

Body oblong-ovate, closely compressed, but not elevated, the abdomen prominent anteriorly, its curve much greater than curve of back. Occiput and thoracic region trenchant. Caudal peduncle very narrow, fin widely forked. Scales small, smooth. Lateral line arched in front, unarmed, or with a few small plates. Head nearly naked. Preorbital low. Mouth rather small, oblique, lower jaw scarcely projecting; upper jaw protractile; maxillary broad, emarginate behind, with large supplemental bone. Jaws, vomer, and palatines with feeble teeth, mostly in a single series. First dorsal of feeble spines, connected by membrane; second dorsal and anal long and low, similar, much longer than the short abdomen. No finlets. Anal spines strong. Ventrals small; pectoral falcate. Gillrakers long.

An American genus, of small size, and little valued as food.

95. Chloroscombrus chrysurus (Linnæus). *Casabe; Bumper.*

Head 3.75; depth 2.33; eye very large, longer than snout, about 3 in head; D. VIII-I, 26; A. II-I, 26. Head rather deeper than long; opercles very short; snout short. Mouth very oblique; maxillary reaching anterior margin of eye. Chord of curved part of lateral line scarcely longer than head, 1.66 to 1.75 times in length of straight part. Lateral line wholly unarmed. Caudal peduncle longer than deep, its diameter less than that of eye; ventrals very small, fitting into a groove in which the vent is situated; pectoral long, falcate, one-third the length.

Greenish above, sides and below golden; a jet-black spot on caudal peduncle above; dark opercular and axillary spots; inside of mouth black; fins not bordered nor tipped with black.

This species ranges from Cape Cod to Brazil; it is very common on our south Atlantic coast and in Cuba, but is not valued as food, the flesh being thin and dry, the bones large. It is apparently not common in Porto Rico, specimens being obtained by us only at Mayaguez and Isabel Segunda.

Scomber chrysurus Linnæus, Syst. Nat., XII, 494, 1766, Charleston, South Carolina.
Scomber chloris Bloch, Ichthyologia, pl. 339, 1793.
Micropteryx cosmopolita Agassiz, Spix, Pisc. Bras., 104, 1829, Brazil.
Scomber latus Gronow, Catalogue Fishes, ed. Gray, 127, 1854, Carolina.
Chloroscombrus caribbæus Girard, Mex. Bound. Surv., Zool., 21, pl. 9, fig. 6, 1859, St. Joseph Island, Texas.
Chloroscombrus chrysurus, Poey, Fauna Puerto-Riqueña, 332, 1881; Stahl, l. c., 77 and 163; 1883; Jordan & Evermann, l. c., 938, 1896.

Genus 61. TRACHINOTUS Lacépède. The Pámpanos or Pompanos.

Body compressed, moderately elevated, general outline ovate. Caudal peduncle short and rather slender. Abdomen not trenchant, shorter than anal fin. Head moderately compressed, very blunt, snout abruptly truncate. Mouth nearly horizontal, the maxillary reaching middle of eye; premaxillaries protractile; maxillary without distinct supplemental bone. Jaws, vomer, and palatines with bands of villiform teeth, which are deciduous with age. Preopercle entire in adult. Gillrakers short. Gill-membranes considerably united. Spinous dorsal represented by six rather low spines, which are connected by membrane in young, but are free in adult. In old examples the spines appear small on account of encroachments of flesh, and ultimately often disappear. Second dorsal long, elevated in front; anal opposite to it and similar in form and size; two stout, nearly free spines in front of anal, and one connected with the fin, these often disappearing with age. Scales small, smooth. Lateral line unarmed, little arched; no caudal keel.

"When extremely young the preoperculum is armed at the angle with three large spines, and smaller ones above and below. The spinous dorsal is developed as a perfect fin, and teeth are present on the jaws and palatine arch. In this stage the species has never been described by previous naturalists, and consequently has received no name, as the corresponding stage of *Naucrates* (*Nauclerus*) has. At an early period the preopercular spines are absorbed into the substance of the preoperculum and disappear. The spinous dorsal and the teeth are still retained. In this condition it remains for some time, the spinous dorsal, however, gradually losing its relative size, while the soft vertical fins increase. In this stage the species belongs to the nominal genus *Doliodon* of Girard. At a later period the membrane connecting the dorsal spines has become obsolete, and the species then represents the genus *Trachinotus*, as understood by Cuvier & Valenciennes and others. Finally, in old age, the teeth of the jaws, palate, and pharyngeal bones have fallen out, and the lobes of the dorsal, anal, and caudal fins attain their greatest extension and become pointed. This final stage has been made known by Holbrook under the new generic name of *Bothrolæmus*" (Gill, Proc. Ac. Nat. Sci. Phila. 1862, 440). The pseudobranchiæ also disappear in old individuals.

Some species of *Trachinotus* (*carolinus*, etc.) are among the most highly valued of our food-fishes.

a. Dorsal with 19 or 20 soft rays; anal with 17 to 19 soft rays.
  b. Body very much compressed; sides with narrow black crossbars; lobes of vertical fins elongate, reaching past middle of caudal fin in adult .... *glaucus*, 96
  bb. Body moderately compressed; sides without narrow black crossbars; lobes of vertical fins shorter, rarely reaching base of caudal; lobes of dorsal and anal usually blackish.
    c. Body broad-ovate; back arched; greatest depth at all ages nearly two-thirds length of body; profile from nostril to dorsal everywhere nearly evenly convex; axil without black spot .... *falcatus*, 97
    cc. Body oblong, the profile not strongly arched; depth in young and old 2 to 2.6 in length of body; dorsal lobes low .... *goodei*
aa. Dorsal with 25 to 27 soft rays; anal with 22 to 26 soft rays; body oblong, rather robust; greatest thickness 3 in greatest depth of body; depth less than half length; lobes of vertical fins short, not black; sides without dark crossbars.
  d. Dorsal with 25 soft rays; anal with 22 soft rays; profile from snout to procumbent spine evenly convex.
    e. Body very deep, depth about half length .... *argenteus*
    ee. Body moderately deep, depth about 2.5 in length .... *carolinus*, 98
  dd. Dorsal with 27 soft rays; anal with 26 .... *cayennensis*

96. Trachinotus glaucus (Bloch). *Gaff-topsail; Pompano; Palometa.*

Head 4; depth 2; eye 3.6. D. vi–i, 19; A. ii–i, 18; pyloric cæca 13. Body elliptical, much compressed; snout blunt, subtruncate, vertical from mouth to horizontal from upper edge of the eye; profile from supraorbital to front of dorsal fin convex. Mouth nearly horizontal; maxillary nearly reaching vertical from middle of eye, its length 3 in head; jaws without teeth in adult; dorsal spines separate in adult; dorsal and anal fins falcate, anterior soft rays reaching middle of caudal fin; dorsal lobe 1.5, anal 1.75 in length of body; ventrals reaching four-fifths distance to vent, their length 2.4 in head; caudal very deeply forked, its lobes nearly half length of body.

Color, bluish above, golden below; lobes of dorsal and anal very dark; rest of fins pale, with bluish edges; caudal bluish; pectorals golden and bluish; ventrals whitish. Body crossed by four black vertical bands, first under procumbent spine, second under third dorsal spine, third and fourth under soft dorsal; a black spot representing a fifth band on lateral line between last rays of dorsal and anal, this sometimes obsolete; the position of the bands appearing to be subject to slight variation.

Young individuals, 2 inches in total length, may be described as follows: Head 2.9; depth 2.6; eye 4; dorsal profile and general form as in adult; anterior dorsal and anal rays not produced; caudal less deeply forked. Color, bright-silvery, merging into metallic-bluish on back and yellowish on lower sides and belly; the four dark vertical bars very faint, but usually distinguishable with a lens, even in very small specimens; the first of these very short and under procumbent spine, second longer and under fourth spine, third and fourth under soft dorsal; the dark spot on posterior part of lateral line usually not evident; anterior rays of dorsal and anal and outer rays of caudal black.

Comparing young examples in our collection from Porto Rico with specimens of similar size from Woods Hole which have been identified as the young of *T. goodei*, it is found that they are difficult to distinguish. The general form, proportional measurements, fins, and general coloration are very much alike, but the black vertical bars are apparently not present on the Woods Hole specimens.

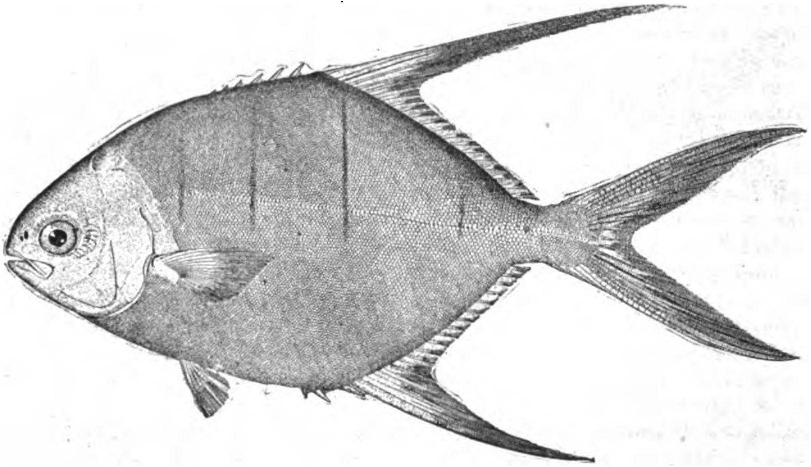

FIG. 37.—*Trachinotus glaucus.*

This species attains a length of a foot or more and is a handsome fish, though not highly esteemed as food. In Porto Rico, however, it is handled by the fishermen and seems to rank with the species of *Caranx* in food value. It is found in tropical America from Virginia to the Caribbean Sea; generally common from the Carolinas to Florida and in Porto Rico. Our collection contains examples from Mayaguez, Aguadilla, Ponce, and Isabel Segunda. Mr. Gray's collection has two from San Geronimo.

Chætodon glaucus Bloch, Ichthyologia, pl. 210, 1787, Martinque; on a drawing by Plumier.
Trachynotus glaucus, Poey, Fauna Puerto-Riqueña, 333, 1881; Stahl, l. c., 77 and 164, 1883.
Trachinotus glaucus, Jordan & Evermann, l. c., 940, 1896.

97. **Trachinotus falcatus** (Linnæus). *Round Pompano; Palometa; Permit.*

Head 3.6; depth 1.6; eye 3.9; snout 3.6; maxillary 3; mandible 2.4; interorbital 2.25; D. VI-I, 19; A. II-I, 17; pectoral 1.4; ventral 2.7; caudal 0.8; scales very numerous.

Body ovate, compressed, back greatly elevated; profile of snout nearly vertical; mouth small, maxillary reaching nearly or quite to middle of eye; teeth deciduous, in villiform bands in younger individuals; anterior ray of dorsal and anal much produced, that of dorsal reaching beyond posterior end of fin, 2.5 in body; that of anal shorter, 3.3 in body; ventrals very small, reaching vent; caudal widely forked, the lobes long.

Color in life: Upper parts bluish-silvery, lower parts silvery; produced dorsal rays black outwardly, anal spines and produced rays reddish-orange, rays blackish at tips; inner edge of caudal lobes lemon, outer margin blackish; ventrals reddish.

T. falcatus is known at once from the other species of the genus by the form of the body and the elevation of dorsal and anal rays, which are longer than in any other of our Atlantic species except *T. glaucus*. Its range is from Cape Cod to Porto Rico and Brazil, common southward, apparently only the young occurring in the Gulf Stream as far north as Woods Hole. It does not seem to be at all common in the Indian River, Florida, though it occurs in some numbers, especially in the southern part of that region. It is not well known to the fishermen, only a few of whom had any name for it. These called it "permit," probably confusing it with the much larger species, *T. goodei*. It is regarded as a fair food-fish. The majority of the specimens seen in the Indian River weighed less than a pound each, and the largest about 3 pounds. In Porto Rico it is held in considerable esteem, ranking perhaps with most other species of the family. It appears to be abundant, as specimens were obtained by us at San Juan market, and at San Antonio Bridge, Palo Seco, Mayaguez, Puerto Real, Boqueron, Ponce, Arroyo, Hucares, and Isabel Segunda. It appeared to be common in most of the markets. Our Porto Rican specimens range from 1.4 to 7 inches in length.

Labrus falcatus Linnæus, Syst. Nat., ed. X, 284, 1758, America.
Chætodon rhomboides Bloch, Ichthyologia, pl. 209, 1787, Martinique; on a drawing by Plumier.
Trachinotus fuscus Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 410, 1831, Brazil.
Trachinotus spinosus De Kay, N. Y. Fauna: Fishes, 117, pl. 19, fig. 53, 1842, New York Harbor.
Trachynotus ovatus, Poey, Fauna Puerto-Riqueña, 333, 1881; Stahl, l. c., 77 and 164, 1883.
Trachinotus falcatus, Jordan & Evermann, l. c., 941, 1896.

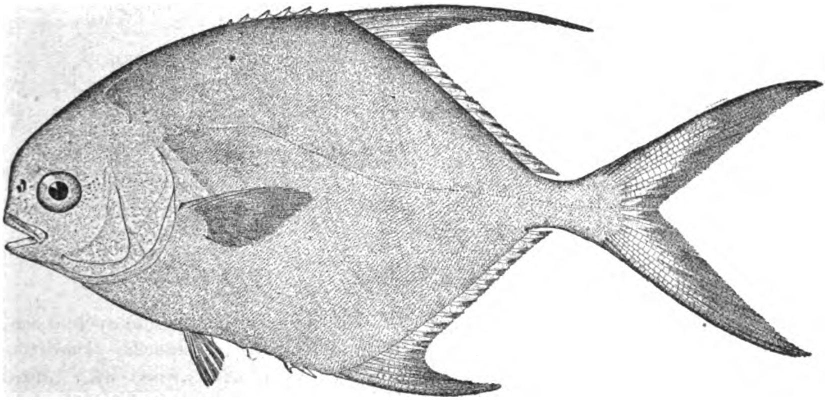

FIG. 38.—*Trachinotus falcatus.*

98. Trachinotus carolinus (Linnæus). *Common Pompano.*

(PLATE 10.)

Head 3.5; depth 2.33; eye 4.1; snout 3.7; maxillary 2.8; mandible 2.4; interorbital 2.7; D. VI–I, 24; A. II–I, 22; pectoral 1.4; ventral 2.2; caudal 9; scales very numerous. Body oblong, compressed, moderately elevated; caudal peduncle short, slender, and much compressed; mouth small, horizontal, jaws equal, maxillary reaching the middle of eye, the teeth in jaws in villiform bands in the young, finally deciduous; a procumbent spine before dorsal; spinous dorsal short and low, spines connected by membrane in young, becoming embedded in the flesh with age, membrane disappearing; anterior rays of soft dorsal and anal elevated and falcate, 1.4 in head in young of 5 inches.

Color, bluish above, silvery below with golden tinge; pectoral and anal light-orange, shaded with bluish; anterior lobe of soft dorsal dusky in young.

Found on the South Atlantic and Gulf coasts of United States, ranging north on sandy shores as far as Cape Cod; said to be rare or accidental in West Indies and Brazil, though we found the young, from 2.5 to 5 inches long, in considerable numbers at Palo Seco, Mayaguez, Ponce, and Isabel Segunda.

The pompano is perhaps the most delicious of all food-fishes. The richness, firmness, and delicacy of flavor of its flesh render it superior not only to all other members of the family to which it belongs, but to any other fish. On the east and west coasts of Florida and about Key West it is held in the highest esteem and is most assiduously sought by the commercial fishermen, to whom it brings the highest price. It reaches a maximum length of nearly 2 feet and a weight of 6 or 8 pounds. The average weight of those taken in Indian River, Florida, probably does not now exceed 2 pounds, though before commercial fishing on that coast was so vigorously prosecuted the average weight was much greater; one was seen 21.5 inches long, weighing 4.5 pounds. At Key West the average weight is said to be about 1.5 pounds and the maximum 5 pounds.

The habits of this important fish have never been carefully studied, and its life-history therefore is not well known. It occurs in the Indian River throughout the year, but is said to be most abundant in the winter months. The best fishing is from January to early April. It is probably common in the summer months, but is not fished for then. It is most abundant about the inlets, playing in and out with the tides. It runs in bunches or schools and is easily influenced by changes in temperature, seeming to prefer rather warm water, and continued cold weather causes them to leave the river temporarily. At Key West the pompano is found only in the winter when the cold weather drives it south. It is fished for there with hook and line, while in Indian River nets are used.

The food of this fish seems to consist very largely of small bivalve shells and small crustaceans. They feed extensively about the inlets, in the surf outside, and are often seen feeding near shore. They are said to have the habit of digging in the mud or sand, which is probably done in their search for food. Not much definite information could be obtained concerning the abundance or the habits of the pompano in Porto Rico. The species was not found in any of the markets of the island nor were any large individuals seen. Our examples are smaller than any we have seen from Florida, but are about the size of those usually observed at Woods Hole in August and September, and from which they do not seem to differ.

The Porto Rican fishermen seem to recognize the species as an important food-fish, but not as being at any time abundant. The shore of the island is, in most places, unfavorable to this fish and it is probably not found in considerable numbers except on the more sandy, protected portions.

Gasterosteus carolinus Linnæus, Syst. Nat., ed. XII, 490, 1766, Carolina.
? *Trachynotus argenteus* Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 410, 1831, New York and Rio Janeiro.
Trachynotus cupreus Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 414, 1831, Martinique.
Trachynotus pampanus Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 415, 1831, Brazil and Charleston, S. C.
Trachinotus carolinus, Jordan & Evermann, l. c., 944, 1896.

Family XXXVII. STROMATEIDÆ. The Fiatolas.

Body compressed and more or less elevated, covered with small or minute cycloid scales. Profile anteriorly blunt and rounded. Mouth small. Premaxillaries not protractile. Dentition feeble; no teeth on vomer or palatines; pharyngeals little developed; œsophagus armed with numerous horny, barbed, or hooked teeth. Opercular bones smooth, not serrate. Gills 4, a slit behind fourth. Gill-membranes either separate and free from (*Stromateinæ*) or broadly joined to isthmus (*Stromateoidinæ*), restricting gill-openings to sides, as in *Chætodipterus*. Gillrakers rather long. Pseudobranchiæ present. Cheeks scaly. Preopercle entire or serrate. Lateral line well developed. Dorsal fin single, long, with the spines few or weak, often obsolete; anal fin long, similar to soft dorsal, usually with 3 small spines, which are often depressible in a fold of skin; ventrals thoracic, I, 5 in the young, but reduced or altogether wanting in the adult; caudal fin well forked. Usually no air-bladder. Pyloric cæca commonly numerous. Vertebræ 30 to 36.

a. Dorsal and anal fins very high in front, anterior lobe falcate; body suborbicular.......... PEPRILUS, 62
aa. Dorsal and anal fins moderately elevated in front, anterior lobe scarcely falcate; side with a series of large, wide-set pores above lateral line.......... PORONOTUS

Genus 62. PEPRILUS* Cuvier. The Butter-fishes.

Body ovate or suborbicular, strongly compressed, tapering into a slender caudal peduncle, which is not keeled or shielded. Head short, compressed, profile obtuse. Mouth small, terminal, jaws subequal. Premaxillaries not protractile. Jaws each with single series of weak teeth. Scales very

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*The name *Rhombus* Lacépède (1800), which has long been in use for this genus, is preoccupied by *Rhombus* Humphreys (1797), a genus of mollusks. The next available name is *Peprilus* of Cuvier (1817).

small, cycloid, silvery, loosely inserted, extending on vertical fins. Opercular bones entire. Gill-membranes separate, free from isthmus; gillrakers moderate. Lateral line continuous, concurrent with back. Dorsal fin long, more or less elevated in front, preceded by a few indistinct spines; usually one or more procumbent spines in front of dorsal and anal, each of these with a free point both anteriorly and posteriorly; anal fin similar to dorsal, or shorter, usually with three small spines; ventral fins wanting; a single small, sharp spine, attached to pubic bone, occupying the place of the ventrals; pectorals long and narrow; caudal widely forked.

There are but few species of this genus, mostly American. *Peprilus* differs from *Stromateus* chiefly in the prominence of the pelvic bone, which projects in a lamina beyond the skin. Species of *Stromateus* occur in Europe and South America, but none within our limits.

Only one of the two recognized species is known from Porto Rico.

a. Dorsal rays III, 43 .... *paru*, 99
aa. Dorsal rays about III, 39 .... *xanthurus*

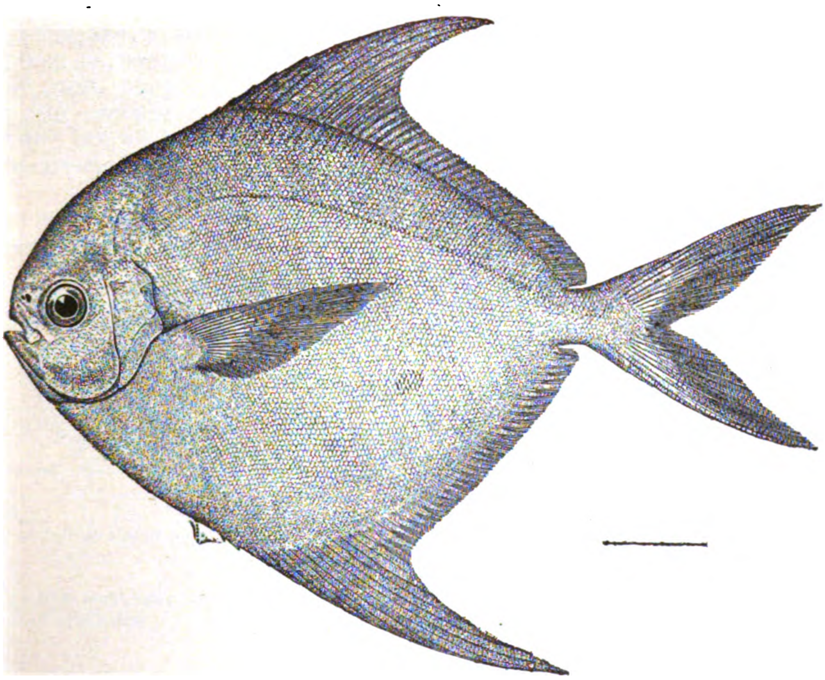

FIG. 39.—*Peprilus paru.*

99. Peprilus paru (Linnæus). "*Palometa*"; *Harvest-fish; Puppy-fish.*

Head 3.6; depth 1.5; eye 3; snout 4.7; maxillary 3.5; mandible 3; interorbital 2.5; D. III, 42; A. II, 39; pectoral and caudal 2.5 in body; scales about 90.

Body nearly circular in outline, strongly compressed, with a very short and slender caudal peduncle; head small, not at all pointed, its anterior outline scarcely breaking the nearly even curve from above and below; mouth very small, oblique, lower jaw not projecting, maxillary reaching front of eye; teeth in jaws small and weak, uniserial; lateral line unarmed; dorsal and anal fins falcate, their anterior rays much produced, those of anal reaching base of caudal or beyond, those of dorsal shorter, reaching middle of fin when depressed; caudal lobes long, equal, the fin well forked; ventrals wanting, a small spine similar to anal spines in their place; scales somewhat deciduous.

Color in life: Pale-blue above, silvery on sides and below, rich bluish or purplish iridescence everywhere; inside of mouth and tongue inky-black, the jaws pale.

Atlantic coast of United States from Massachusetts south to Jamaica, Porto Rico, and Brazil.

This species reaches a length of 6 to 8 inches, a weight of a half pound or more, and is a highly valued pan-fish, particularly common along our south Atlantic coast. It is apparently not common in Porto Rico, as only two specimens were obtained, 6.5 and 7.5 inches long, respectively, from the San Juan market.

Paru Brasiliense congener, Sloane, Hist. Jamaica, 285, 1727, Jamaica.
Stromateus paru Linnæus, Syst. Nat., ed. X, 248, 1758, Jamaica; based on Sloane.
Chætodon alepidotus Linnæus, Syst. Nat., ed. XII, 460, 1766, Charleston.
Sternoptyx gardenii Bloch & Schneider, Syst. Ichth., 494, 1801, Charleston; after Linnæus.
Stromateus longipinnis Mitchill, Trans. Lit. & Philos. Soc. N. Y., I, 1815, 366, New York.
Rhombus paru, Jordan & Evermann, l. c., 966, 1896.
Peprilus paru, Jordan & Evermann, l. c., 3197, 1900.

Family XXXVIII. CHEILODIPTERIDÆ. The Cardinal-fishes.

Body oblong or elongate, sometimes compressed and elevated, covered with rather large scales, which are striated and ctenoid or sometimes cycloid; cheeks scaly; lateral line continuous; cleft of the mouth wide, oblique; villiform teeth on jaws and vomer, and sometimes on palatines; canines sometimes present (teeth wanting in *Brephostoma*); preopercle with a double ridge, its edge entire or slightly serrated; opercular spine little developed; lower pharyngeals separate, with sharp teeth; pseudobranchiæ present; branchiostegals 6 or 7. Dorsal fins well separated, the first with 6 to 9 rather strong spines; no dorsal sheath or furrow; anal fin short, usually with 2 spines, sometimes with 3 or 4; ventral fins thoracic, I, 5, without axillary scale.

Small fishes of the tropics, especially abundant in the East Indies, some of them in fresh water, most of them in rather deep waters. Color often bright-red. Genera about 15; species about 130.

CHEILODIPTERINÆ:
a. Body oblong, not greatly compressed nor greatly elongate; anal spines 2, rarely 3; teeth present in jaws at least.
b. Anal fin with two spines; soft rays usually 8 or 9.
c. Canines none; teeth all villiform; lateral line normal.
d. Palatines with teeth.
e. Scales large, 20 to 30 in lateral line.
f. Preopercle with its posterior edge distinctly serrate, at least in young .... APOGON, 63
ff. Preopercle with its ridges entire at all ages .... APOGONICHTHYS, 64
ee. Scales small, 40 to 45 in lateral line .... GLOSSAMIA
dd. Palatines toothless; teeth moderate; eye very large; body elongate; scales rather small; preopercle entire or nearly so .... EPIGONUS
cc. Canines present in jaws. Dorsal spines 6; opercle unarmed; anal spines 2 .... CHEILODIPTERUS
bb. Anal fin with 3 spines and 8 soft rays; no teeth on vomer or palatines; no canines; caudal rounded; opercles entire; body moderately elongate .... AMIICHTHYS
SCOMBROPINÆ.
aa. Body elongate, the form approaching that of the barracuda (*Sphyræna*); mouth large; anal spines 3 or 4.
g. Teeth subequal, without distinct canines; preopercle serrate. D. VII-I, 10; A. III, 7; scales small, about 60. SPHYRÆNOPS
gg. Teeth unequal, jaws with long canines; preopercle entire or nearly so.
h. Second dorsal and anal long, each of 12 to 14 soft rays; soft parts of vertical fins scaly; scales rather small, 45 to 50. SCOMBROPS
hh. Second dorsal and anal short, each with 7 to 9 soft rays; vertical fins scarcely scaly; scales large, about 30. HYPOCLYDONIA

Genus 63. APOGON Lacépède. Kings of the Mullets.

Body oblong, compressed, covered with large ctenoid scales. Lateral line continuous, with 20 to 30 scales. Head large; mouth wide, oblique, maxillary extending to below middle of large eye; villiform teeth on jaws, vomer, and palatines; no canine teeth; preopercle with a double ridge, the edge somewhat serrate, at least in the young, becoming entire with age in some species; opercle with spine behind. Gillrakers rather long. Dorsal spines 6 or 7, strong; second dorsal remote, short; anal with 2 spines and 8 or 9 soft rays, second much the longer, soft part similar to soft dorsal; pectorals and ventrals moderate; vertebræ 11 + 14 = 25. Warm seas; the species numerous.

a. Base of caudal with a distinct round blackish blotch (rarely wanting).
b. Base of soft dorsal without blackish saddle-like blotch.
c. Opercle without dark spot; cheek without evident dark dots; soft dorsal much higher than spinous; scales 28 to 30 .... *imberbis*
aa. Base of caudal without blackish blotch.

d. Soft dorsal with a round black blotch below it and a similar one on caudal peduncle above; scales 26... *maculatus*
dd. Soft dorsal and caudal peduncle without round black spots.
c. Body with few black specks or none; a blackish bar between last rays of soft dorsal and anal; another on caudal peduncle .... *binotatus*
cc. Body covered everywhere with blackish dots, like fly-specks; no other distinct markings; scales 25.. *pigmentarius*
aaa. A broad saddle-like dark blotch on caudal peduncle; scales 27.. *sellicauda*, 100

100. **Apogon sellicauda** Evermann & Marsh, new species.

Head 2.6; depth 3; eye 2.7; snout 4.75; maxillary 2; mandible 2.2; interorbital 4; D. VI–I, 9; A. II, 7; scales 2–27–10. Body rather short; head large; caudal peduncle long, deep, and compressed; mouth large, little oblique, maxillary reaching past pupil; eye very large; preopercle finely serrate; scales large, finely ctenoid; lateral line complete, following curve of back. Fins moderate; second and third dorsal spines longest; first anal spine very short, second about equal to eye; pectoral long, 1.65 in head.

Color in life: Rich scarlet, nearly uniform; a jet-black spot as large as pupil on opercle and another of same size on side between lateral line and base of soft dorsal; a dark blotch from opercular spot to eye, beneath which are a few brownish specks; axil of pectoral somewhat dusky; top of head and snout with small black specks; caudal peduncle with a broad saddle-like dusky area close to base of caudal fin; a few small dark specks on dorsal, anal, and caudal fins.

In alcohol, the color fades to pale yellowish-white, the black spots and specks persisting.

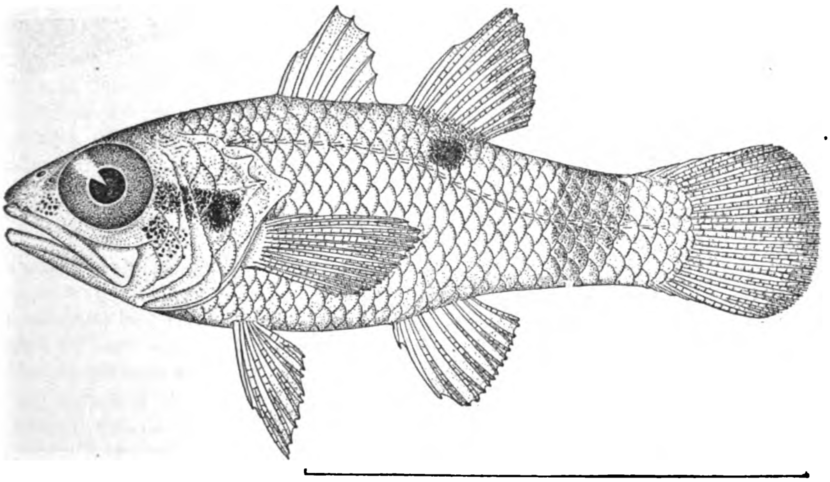

FIG. 40.—*Apogon sellicauda.*

This interesting species is evidently close to *A. maculatus*, but differs in its much larger eye and in coloration. In four specimens of *A. maculatus* examined the eye was 3.25, 3.3, 3.5, and 3.5 in head, respectively. A specimen of the same size as the type of the present species has the eye 3.5 as against 2.7 in said type. The coloration is also very different. In *A. maculatus* there is a definite lateral black spot about the size of the pupil on the upper posterior part of the caudal peduncle; the opercle and postocular region in some specimens have a few minute dark specks sometimes forming an obscure opercular blotch; and the tips of the anterior dorsal and anal rays and the outer caudal rays are quite black. In *A. sellicauda*, instead of the definite black spot on the caudal peduncle, there is a broad dark saddle-like area completely surrounding the peduncle except, possibly, at the under edge; there is a definite black spot nearly as large as that under soft dorsal, on the middle part of the opercle, and from this a broad dark band runs forward to the eye. The tips of the caudal lobes and of the anal and soft dorsal are broken in the type, but they do not seem to have been black, as in *A. maculatus*.

This species is based upon a single specimen, 1.63 inches long, obtained February 11, 1899, on a coral reef at Culebra Island. Type No. 49529 U. S. N. M. (*sella*, saddle; *cauda*, tail.)

Genus 64. APOGONICHTHYS Bleeker.

This genus differs from *Apogon* only in having the preopercle entire at all ages; scales very large (20 to 26) and cycloid. Small species, similar in habit to those of *Apogon*, found in the tropical seas. The genus is scarcely distinct from *Apogon*.

a. Scales in lateral line 21 to 23; body with many dark points.
b. Ventrals short, not reaching vent; dorsal rays vi-i, 9 .... *alutus*, 101
bb. Ventrals long, extending beyond anal; dorsal rays vii-i, 9 .... *stellatus*
aa. Scales in lateral line 30; ventrals long, reaching beyond front of anal; body everywhere with black specks; dorsal vi-i, 9 .... *puncticulatus*

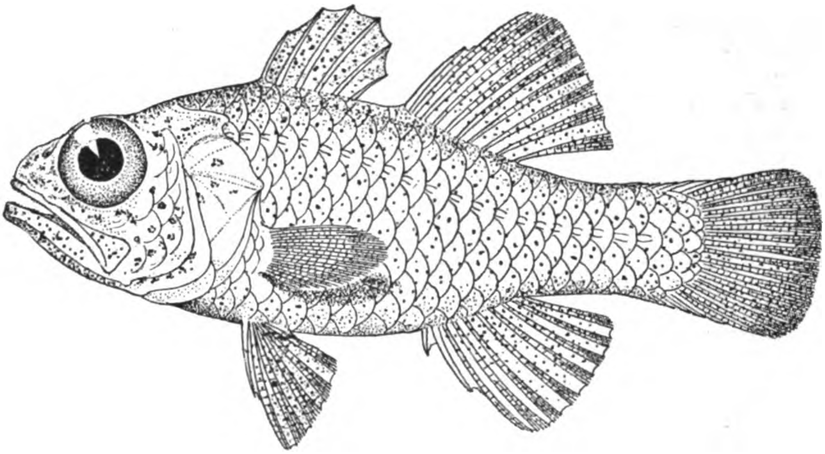

FIG. 41.—*Apogonichthys alutus*.

101. Apogonichthys alutus (Jordan & Gilbert).

Head 2.4; depth 2.75; eye 3; snout 4.75; maxillary 2; mandible 1.8; interorbital 4; D. vi–i, 9; A. ii, 9; scales 1–22–7. Body short and deep; head compressed, short and high, its height at occiput six-sevenths its length; snout short and blunt, less than interorbital width, about half diameter of orbit; mouth very oblique, maxillary reaching beyond pupil, but not to posterior margin of orbit; length of maxillary 1.75 in head; teeth in narrow villiform bands in each jaw, those on vomer and palatines minute; eye of moderate size, 2.8 in head; orbital rim elevated above and behind; interorbital width 3.33 in head, with a low median longitudinal ridge; both ridges of preopercle entire; opercle without spine; gillrakers slender, longest rather more than half diameter of orbit, 8 or 9 on anterior branch of outer arch. First dorsal low, of 6 rather weak spines, its base two-fifths length of head, and equal to greatest height of fin; second dorsal high, longest ray 1.5 in head. Anal similar to second dorsal; second anal spine half length of longest ray, which is contained 1.75 in head; caudal 1.33; ventrals not reaching vent, 1.66, and pectorals 1.75 in length of head.

Color, rusty-red, with silvery luster; sides of head little reddish; body and fins everywhere much soiled and freckled with dark points; first dorsal blackish, thickly punctate; second dorsal, anal, and caudal yellow, smutty, with dark points, posterior half of the caudal more dusky; ventrals smutty-yellow; pectorals colorless.

Found on the Snapper Banks off Pensacola and Tampa and at Porto Rico, where one specimen 2 inches long was seined in Guanica Bay January 28. Until now the only specimens known had been obtained from the stomachs of red snappers, *Neomænis aya*, which probably all came from depths of 20 to 50 fathoms. The finding of this species in shallow water near the shore is therefore an interesting addition to our knowledge of its habits.

Apogon alutus Jordan & Gilbert, Proc. U. S. N. M. 1882, 279, Snapper Banks off west coast of Florida.
Apogonichthys alutus, Jordan & Evermann, l. c., 1110, 1896.

Family XXXIX. CENTROPOMIDÆ. The Robalos.

This family is defined thus by Professor Gill (Proc. U. S. N. M. 1882, 484):

"Typical acanthopterygians with the postorbital portion of the skull longer than the oculo-rostral; the parietals behind the constriction continuous with the epiotics and transverse laminæ arising from the supraoccipital crest, the three together forming a well differentiated posterior oblong pentagonal or hastiform area; the re-entering parietal sinus, with its anterior margin, produced forward nearest the opisthotics; the exoccipitals well developed and contiguous above the foramen magnum; the vertebræ in typical number (10 + 14) and longish; the anterior two partly coossified and the first with selliform apophyses extending backward and embracing the second vertebra; the vertebræ mostly with foveæ or pits for the ribs and only with developed parapophyses for the posterior (6 to 10) pairs of ribs; the second neural spine suberect, and with laminiform extensions, which embrace the first; neurapophyses and neural spines of other vertebræ depressed at their bases continuous with the zygapophyses in front, and slightly curved upward at their tips; the hæmal spines resembling the neural."

Subocular laminæ produced behind in a pointed process. External characters are the elongate body, with elevated back, straight abdomen, and angulated base of anal. Scales ctenoid, varying in size, lateral line conspicuous, extending on caudal fin, the tubes straight, confined to basal half of scale. Head depressed, pike-like, lower jaw projecting; villiform teeth, in bands, on jaws, vomer, and palatines; tongue smooth. Maxillary broad, truncate behind, with a strong supplemental bone. Pseudobranchiæ present, small. Preopercle with a double ridge, posterior margin strongly serrated, with larger spines at angle; preorbital and suprascapula serrated, opercle without true spines. Gillrakers long. Dorsal fins well separated, first with 8 spines, first and second short, third and fourth longest; anal with 3 spines, second strong, third long and slender, these fins moving in scaly sheaths. Caudal forked. Ventrals large, I, 5, inserted well behind pectorals, a scaly process at their base; pectorals narrow and rather pointed, upper rays longer than lower. Branchiostegals 7. Air-bladder well developed, simple, or with appendages anteriorly.

This family comprises about 15 species, all American and referred to one genus. They are game-fishes, excellent as food.

Genus 65. CENTROPOMUS Lacépède. The Robalos.

The characters of this genus are included in the above.

In American waters this genus contains 14 species, as recognized by Jordan & Evermann, only 2 of which are known from Porto Rico. All the species are of some value as food-fishes and some of them reach a large size. They occur on both coasts of tropical America and are fishes of shallow or moderate depths, two or three of them even ascending fresh-water streams for considerable distances.

a. Preorbital entire or very faintly serrated; spines of fins moderate, none more than half head; lateral line black, with about 70 scales (pores); caudal fin short; air-bladder usually with recurved appendages at its anterior end; anal with 6 soft rays, the last cleft to base. Size large.
b. Appendages to air-bladder short, shorter than eye; second anal spine projecting beyond third.... *undecimalis*, 102
aa. Preorbital with well-developed retrorse teeth, especially posteriorly; air-bladder without appendages; spines longer. Size comparatively small.
c. Lateral line in a narrow black streak.
d. Scales moderate or large, 50 to 60 in lateral line; second anal spine very strong; ventrals more or less dusky, usually broadly tipped with black; anal rays III, 7, second spine a little shorter than third.
e. Scales in lateral line 57 to 60; second anal spine very long, 1.25 to 1.60 in head; depth of body 3.66 in length .... *pedimacula*
ee. Scales in lateral line 51 or 52; second anal spine 1.66 in head. Body more slender, the depth 3.75 in length.. *cuvieri*
dd. Scales small, about 70 in lateral line; ventrals pale; second anal spine strong, equal to depth of body; anal rays III, 6 .... *mexicanus*
cc. Lateral line pale, not in a dark stripe; ventral fins yellowish, without black tip.
f. Scales very small, about 80; sides of body parallel with each other; second anal spine longer than third, equal to depth of body; anal rays III, 7 .... *parallelus*, 103
ff. Scales small, 65; second anal spine very long, about equal to depth of body; third anal spine same length; angle of preopercle with about 6 long, comb-like teeth; anal rays III, 7 .... *pectinatus*
fff. Scales large, 49 to 53 in lateral line; eye moderate, about 6 in head; anal rays III, 6.
g. Body moderately elongate, the depth 3.25 to 3.66 in length.
h. Scales before dorsal small, 16 to 18 in number; maxillary reaching past front of pupil. Third dorsal spine half head; scales 51 .... *armatus*
hh. Scales before dorsal not crowded, 10 to 14 in number; maxillary barely reaching front of pupil; third dorsal spine less than half head; scales 7-53-11 .... *affinis*
gg. Body more elongate, depth 4 in length; the second anal spine excessively long, 1.4 times depth of the body; scales 53 .... *ensiferus*

102. Centropomus undecimalis (Bloch). "*Robalo*"; *Snook*.

Head 3; depth 4.25; eye 7.75; snout 3.5; maxillary 2.5, reaching past middle of eye; interorbital equal to eye; D. VII or VIII-I, 10; A. III, 6; scales 9–75–12, about 18 before dorsal; gillrakers 4 + 9. Body stout, not much compressed; head long and pointed; mouth large; lower jaw strongly projecting; preorbital faintly or not at all serrate; preopercle and interopercle serrate; subopercular flap broad; cranial ridges prominent; caudal peduncle stout, its least width 2.5 in its least depths; fins moderate; first and second dorsal spines very short, first sometimes absent, third about 2 in head; first anal spine very short, second very strong, about 2.6 in head, usually a little longer than third, which is more slender; pectorals long, about 2 in head; ventrals long, slightly greater than the pectoral; scales moderate, closely imbricated, rather firm.

Color in life: Irregularly iridescent-green above; top of head grayish, cheeks silvery, with golden wash; lower jaw flesh-color, with some blue; lateral line darkest posteriorly; side silvery, with light purple iridescence; under parts white; fins all pale, ventrals darker at tips, caudal dark-edged.

Color in spirits: Greenish-olive, sides dull-silvery, lighter below; fins all pale except dorsals, which are dark; lateral line black.

A common food-fish in Porto Rico, where it reaches a length of 2 or 3 feet or more. Specimens were obtained at San Juan, Ponce, Palo Seco, Mayaguez, and Arroyo.

Sciæna undecimalis Bloch, Ichth., VI, 60, pl. 303, 1792, Jamaica.
Centropomus undecimradiatus Lacépède, Hist. Nat. Poiss., IV, 268, 1802, Jamaica; after Bloch.
Perca loubina Lacépède, Hist. Nat. Poiss., IV, 397, 1802, Cayenne.
Sphyræna aureoviridis Lacépède, Hist. Nat. Poiss., V, 324, 1803, Martinique.
Centropomus appendiculatus Poey, Memorias, II, 119, 1860, Havana and Cienfuegos.
Centropomus undecimalis, Poey, Fauna Puerto-Riqueña, 321, 1881; Stahl, l. c., 76 and 162, 1883; Jordan & Evermann, l. c., 1118, 1896.

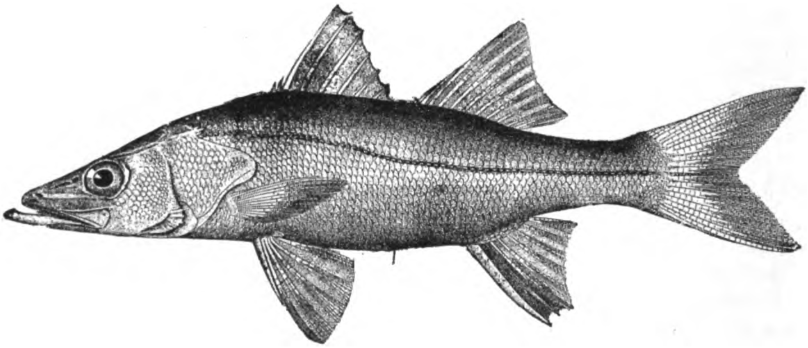

FIG. 42.—*Centropomus undecimalis.*

103. Centropomus parallelus Poey. "*Robalo.*"

Head 2.7; depth 3.33; eye 5.7; snout 3.4; maxillary 2.4, reaching past middle of eye; mandible 1.6; interorbital 7, less than eye; D. VIII-I, 10; A. III, 7; scales 12–80–14. Back considerably elevated, making body deeper and anterior profile more steep than in *C. undecimalis*. It differs also from that species in the much less projecting lower jaw, stronger serrations of preorbital and preopercle, smaller scales, and color of the lateral line, which is pale instead of black.

Our specimens differ slightly from Poey's description of *C. parallelus:* Second anal spine but two-thirds depth of body, third very nearly as long as second; otherwise identical with it.

Color, silvery in life, inclining to brassy-olive on back; in spirits, faint longitudinal streaks, pale below but brownish on back, traverse the rows of scales.

This is a small species, rarely exceeding a foot in length, found about Cuba, Santo Domingo, Porto Rico, and at Pernambuco. It enters rivers and lakes and may be found at long distances from salt water. In Porto Rico it ascends the larger streams well toward the interior of the island. Numerous examples from the Rio Loiza were seen hawked about the streets of Caguas. One from this place is a foot in length. *C. undecimalis* also enters the rivers but does not ascend so far as does this one. Each species possesses some game qualities and both are sought by the local anglers. The best fishing is said to be in the lower portions of the Rio de la Plata, Manati, and the Rio Grande de Arecibo.

Centropomus parallelus Poey, Memorias, II, 120, 1860, Havana and Cienfuegos; Jordan & Evermann, l. c., 1122, 1896.

Family XL. SERRANIDÆ. The Sea Basses.

Body oblong, more or less compressed, covered with adherent scales of moderate or small size, which are usually but not always ctenoid; dorsal and ventral outlines usually not perfectly corresponding. Mouth moderate or large, not very oblique, the premaxillary protractile, and broad maxillary usually not slipping for its whole length into a sheath formed by preorbital, which is usually narrow. Supplemental maxillary present or absent. Teeth all conical or pointed, in bands, present on jaws, vomer, and palatines. Gillrakers long or short, usually stiff, armed with teeth. Gills 4, a long slit behind fourth. Pseudobranchiæ present, large. Lower pharyngeals rather narrow, with pointed teeth, separate (except in *Centrogenys*). Gill-membranes separate, free from isthmus. Branchiostegals normally 7 (occasionally 6). Cheeks and opercles always scaly; preopercle with its margin more or less serrate, rarely entire; opercle usually ending in one or two flat spine-like points. Nostrils double. Lateral line single, not extending on caudal fin. Skull without cranial spines and usually without well-developed cavernous structure. No suborbital stay. Post-temporal normal. Second suborbital with an internal lamina supporting globe of eye; entopterygoid present; all or most of the ribs inserted on transverse processes when these are developed; anterior vertebræ without transverse processes. Dorsal spines usually stiff, 2 to 15 in number; soft dorsal with 10 to 30 rays; anal fin rather short, its soft rays 7 to 12, its spines, if present, always 3, in certain genera (*Grammistinæ*, *Rypticinæ*) altogether wanting. Ventrals thoracic, usually I, 5 (I, 4, in *Plesiopinæ*), normally developed, without distinct axillary scale. Pectoral well developed, with narrow base, rays branched. Caudal peduncle stout, the fin variously formed. Vertebræ typically 10 + 14 = 24, number sometimes increased, never more than 35. Air-bladder present, usually small, and adherent to wall of abdomen. Stomach cæcal, with few or many pyloric appendages; intestines short, as is usual in carnivorous fishes.

The *Serranidæ* include 60 to 70 genera and about 400 species; carnivorous fishes, chiefly marine, and found in all warm seas; several genera found in fresh waters, comprising most of the family of *Percidæ*, as understood by Günther and others, exclusive of those with imperfect pseudobranchiæ, those with one or two anal spines, those with the number of vertebræ increased, those in which the whole length of maxillary slips under preorbital, and those with anal fin many-rayed, and cranium shortened behind.

a. Anal spines 3, well developed. Dorsal fin single, sometimes deeply divided.

b. Maxillary with a distinct supplemental bone (rarely obscured by the skin); dorsal usually divided or deeply notched

c. Inner teeth of jaws not depressible nor hinged.

LIOPROPOMINÆ:

d. Soft dorsal longer than spinous part; dorsal deeply divided, spines 6 to 9 in number; preopercle entire; vertebræ 10 + 14 = 24; lateral line arched anteriorly.

e. Dorsal spines 9; caudal lunate .... LIOPROPOMA

ee. Dorsal spines 6; caudal truncate .... CHORISTISTIUM

POLYPRIONINÆ:

dd. Soft dorsal shorter than spinous part; vertebræ more than 24 (25 to 36); head without rugose dermal ossifications. Teeth all villiform, without canines; soft dorsal with 10 to 12 rays. Head armed with rough spinigerous crests, there being spinous projections above the eyes and a rough, bony ridge on opercle, with others on post-temporal; dorsal fin low, continuous; tongue with teeth; dorsal spines 11 or 12; soft dorsal scaly; caudal rounded; ventral not inserted before axil of pectoral; pyloric cæca numerous (about 70); vertebræ 27 .... POLYPRION

EPINEPHELINÆ:

cc. Inner teeth of jaws depressible or hinged; canine teeth more or less distinct, in front of each jaw; scales small, firm, the top of head more or less scaly; lateral line running low (except in *Gonioplectrus*, etc.); supraoccipital crest usually more or less encroaching on the top of the skull, so as to leave no distinct smooth area at vertex (except in *Variola*); temporal crests usually distinct; gillrakers various, generally small and short. Dorsal rays VIII to XIV, 12 to 20, number of spines usually not 10; anal rays III, 7 to III, 12; ventral fins inserted more or less behind axil of pectoral; head unarmed, except for opercular spines and serræ on preopercle; soft dorsal scaly; scales of lateral line usually triangular and cycloid; vertebræ almost always 10 + 14 = 24, rarely 26 or 27. Chiefly shore fishes, often of large size; all of them, so far as known, bisexual.

f. Pectoral unsymmetrical, its upper rays longest; dorsal spines 8; plectroid spine on preopercle single, very strong; a strong canine on middle of side of lower jaw; opercle with a long, knife-shaped spine; body rather deep; lateral line running high; jaws naked; scales small, firm, and rough; caudal rounded; soft dorsal rather short, of 12 or 13 rays .... GONIOPLECTRUS

ff. Pectoral rounded, symmetrical, its middle rays longest; canines usually distinct, in front of one or both jaws.

g. Frontals with a transverse ridge on posterior part in front of supraoccipital connecting the parietal crests; frontal bones without processes or longitudinal ridges on upper surface; dorsal spines always 9. Posterior process of premaxillary extending to between frontals; mandible without curved canines on its sides; caudal not forked; scales ctenoid .... PETROMETOPON, 66

gg. Frontals without transverse ridge.

h. Dorsal spines 9; soft dorsal of moderate length and height, its rays 13 to 15; anal rays III, 7 or 8; skull and head essentially as in *Epinephelus*, snout not very short, frontal region flat or convex, supraoccipital crest continued forward over it; lateral crest short, low and diverging; mouth and teeth as in *Epinephelus* ...... BODIANUS, 67 *hh.* Dorsal spines 11 (rarely 10, never 9).

i. Parietal crests not produced forward on frontals; frontals with process or knob on each side, behind interorbital area; premaxillary processes fitting into a cavity at anterior extremity of frontals, or into an emargination of these bones; anal rays III, 8, or III, 9.

j. Scales of the lateral line normal, marked by radiating ridges.

k. Cranium narrow above interorbital space, deeply concave; occipital crest meeting interorbital region. EPINEPHELUS, 68

kk. Cranium very broad and flat above; interorbital little concave, occipital crest disappearing before reaching interorbital region .... GARRUPA

jj. Scales of lateral line each with 4 to 6 strong radiating ridges; cranium short, extremely broad, and depressed between eyes; anterior profile of head a little concave; dorsal spines low; dorsal rays XI, 16 ...... PROMICROPS

ii. Parietal crests produced forward on frontals.

l. Frontals with a process or knob on each side behind interorbital area; premaxillaries fitting into a cavity at anterior extremity of frontals; anal rays III, 8, rarely III, 9.

m. Preopercle with a single antrorse hook or spine near angle; supraoccipital and parietal crests not extending to between orbits; scales ctenoid .... ALPHESTES, 69

mm. Preopercle without antrorse spine; supraoccipital and parietal crests extending to between orbits; scales smooth. DERMATOLEPIS

ll. Frontals without processes on upper surface; parietal crests extending to between orbits; premaxillary processes not extending to frontals. Anal fin elongate, its rays III, 11, or III, 12 (very rarely III, 9 or III, 10) caudal fin lunate or truncate; dorsal rays XI, 16 to 18 .... MYCTEROPERCA, 70

bb. Maxillary without supplemental bone; canine teeth, if present, usually developed on side of lower jaw as well as in front; no depressible teeth; scales mostly ctenoid, including those of lateral line; tubes of lateral line straight or with an ascending tubule, covering most of length of scale. Temporal crests on cranium almost obsolete.

SERRANINÆ:

n. Gillrakers comparatively short and wide apart; lateral line not running close to back (except in *Serranus*); dorsal rays X, 11 to 15; anal rays usually III, 7; supraoccipital crest not extending far forward on top of skull, a more or less distinct convex smooth area being left on vertex between supraoccipital and interorbital area; mouth not very oblique; vertebræ about 10 + 14 = 24. Chiefly shore fishes of olivaceous colors.

o. Ventral fins inserted below, or more or less behind, axil of pectoral; branchiostegals 7.

p. Dorsal without long filamentous spines, not more than one of its spines specially produced. Body short and deep, with elevated back, depth more than two-fifths length, usually nearly half; preopercle with a few antrorse serræ on its lower limb; top of supraoccipital crest very high, about as long as smooth area on vertex of cranium, which is well developed, as in *Serranus* and *Prionodes*. Top of head naked; dorsal rays usually X, 14.. HYPOPLECTRUS

oo. Ventral fins anterior, inserted more or less in advance of axil of pectoral, well separated; upper half of pectoral fin usually vertically truncate.

q. Smooth area on top of cranium very short and small; the long supraoccipital crest encroaching on posterior border of cranium so that the latter in profile is not nearly vertical along occipital region. Caudal fin not lunate, rounded, or ending in 3 points, middle rays produced like outer ones .... CENTROPRISTES

qq. Smooth area on top of cranium very large, longer than the supraoccipital crest, which is low and short; posterior border of cranium at occipital region nearly vertical in profile. Caudal fin lunate or truncate.

r. Branchiostegals 7; caudal fin forked or lunate; none of dorsal spines elongate.

s. Preopercle with numerous strong diverging spines at its angle, these spines diverging from one or two centers; preorbital broader than maxillary, which is widest near its middle; scales rather large........ DIPLECTRUM, 71

ss. Preopercle simply and rather finely serrate; preorbital narrow .... PRIONODES, 72

rr. Branchiostegals 6; caudal fin truncate .... DULES, 73

nn. Gillrakers (in American species) very long, slender, and close-set; lateral line running close to back; supraoccipital crest high; occiput with a short convex smooth area; canines strong; no depressible teeth; preorbital narrow; maxillary without supplemental bone or with a rudiment only.

ANTHIINÆ:

t. Lateral line complete and continuous, extending to base of caudal; ventral rays I, 5; dorsal rays IX to XII, 9 to 20; anal rays III, 7 to 10; pectoral rays branched; snout short, mostly convex in profile. Fishes of rather deep waters, chiefly bright-red in life.

u. Dorsal spines 9, all low; soft rays about 19. Caudal fin deeply forked, lobes produced; scales small, ctenoid; ventrals long, inserted behind axil of pectoral; maxillary scaly; frontal region flattish, supraoccipital crest very prominent .... PARANTHIAS

uu. Dorsal spines 10 or more; scales not very small; preopercle angular, with salient teeth at its angle; one or more dorsal spines sometimes filamentous; ventral fins long.

v. Maxillary and frontal region naked; tongue mostly toothless; caudal fin lunate; parietals weak; posterior process of premaxillary reaching frontals. Ventrals inserted behind axil of pectoral; scales 50 to 60.....HEMIANTHIAS

vv. Maxillary scaly; top of head scaled to snout.

w. Pterygoids toothless; tongue with few teeth or none; caudal forked .... ANTHIAS

ww. Pterygoids with a large patch of teeth; tongue toothed; parietal crest strong, extending to above eye; posterior processes of premaxillary not reaching frontals; caudal truncate, with outer rays much produced. OCYANTHIAS

tt. Lateral line interrupted, running close to back, beginning again on caudal peduncle.

GRAMMINÆ:

x. Ventral rays I, 5; preopercle serrate; caudal convex; scales rather large, somewhat ctenoid; dorsal spines 12. GRAMMA

RYPTICINÆ:

aa. Anal spines wanting; dorsal spines 2 to 4 only; preorbital narrow; no canine teeth; scales small, smooth, embedded. RYPTICUS, 74

Genus 66. PETROMETOPON Gill. Enjambres.

Frontal bones with an anterior groove or excavation for reception of posterior processes of the premaxillaries, without processes on upper surface; a curved or angular ridge across posterior portion of frontals in front of supraoccipital, connecting parietal crests; supraoccipital and parietal crests not produced forward. Dorsal spines 9; anal rays mostly III, 8; scales ctenoid; otherwise essentially as in *Epinephelus*.

Species rather few, mostly of small size, distinguished from *Bodianus* chiefly by the peculiarities of the frontal bones, the above account being taken from Boulenger, Cat., I, 175.

104. Petrometopon cruentatus (Lacépède). "*Cabrilla*"; *Enjambre; Coney; Red Hind.*

Head 2.5; depth 2.8; eye 5.5; snout 4; maxillary 2; mandible 1.6; interorbital 6.7; preorbital 11; D. IX, 14; A. III, 8; pectoral 1.7; ventral 2.1; caudal 1.7; scales about 12–85 to 95–30.

Body not greatly elongate, somewhat compressed; caudal peduncle short; head moderate, pointed; mouth large, the large maxillary reaching beyond eye, lower jaw moderately projecting; teeth much as in *Epinephelus*, depressible teeth long and slender; outer row on sides of upper jaw enlarged but not depressible; canines in front of both jaws, the upper somewhat larger; preopercle convex, with very minute serrations; opercle ending in 3 flat, exposed spines, opercular flap thin and rounded or obtusely pointed. Scales ctenoid. Dorsal fin continuous, with a slight emargination; spines slender and sharp; caudal rounded or almost double-truncate; pectoral reaching considerably beyond tip of ventrals, which do not reach vent.

Color in life, reddish-gray with red spots nearly everywhere. Our single specimen, in spirits, is a rather dark brown, the spots appearing brown posteriorly and pale forward, largest and plainest on head; on anterior part of body they have faded almost entirely; the four larger very black spots along base of dorsal are still visible; fins spotted and barred; caudal edged with a moderate band of dark, outside of which is a very narrow pale edging.

This fish ranges from Florida and West Indies to Brazil; is common about Jamaica and Cuba, and not uncommon on the reefs about Key West, where it is called "coney." A handsome species of considerable importance as a food-fish; length about a foot. One specimen, 8.5 inches, from Isabel Segunda, obtained from the local fishermen.

Sparus cruentatus Lacépède, Hist. Nat. Poiss., IV, 157, pl. 4, fig. 1, 1803, Martinique; on a copy of a drawing by Plumier.
Serranus apiarius Poey, Memorias, II, 143, 1860, Havana.
Petrometopon cruentatus, Jordan & Evermann, l. c., 1141, 1896.

Genus 67. BODIANUS Bloch.

This genus is close to *Epinephelus*, from which it is separated mainly by the presence of 9 spines in dorsal fin instead of 11. In character of cranium the two genera differ little, the skull above having its bones thin and smooth, the angular ridge on posterior part of frontals being wanting, and parietal and supraoccipital crests not extending on frontals.

Species rather numerous in warm seas, of small size and bright color. Of seven American species and subspecies of *Bodianus* recognized by Jordan & Evermann two were obtained in Porto Rico.

BODIANUS:
a. Scales ctenoid; none of dorsal spines elevated.
b. Caudal fin not lunate; head and body with few or many small, blue, dark-edged spots.
c. Caudal fin rounded, the middle rays longest; snout with 1 or 2 blue stripes; back of tail without conspicuous black blotch; scales small; lateral line about 115 .... *tæniops*
cc. Caudal fin truncate, middle and outer rays about equal; snout without stripes; back of tail with 2 black spots; lower jaw with a black spot at tip; scales moderate; lateral line about 90.
d. Ground-color lemon-yellow; blue spots few .... *fulvus*
dd. Ground-color bright scarlet .... *ruber*, 105
ddd. Ground-color brown .... *punctatus*, 106
MENEPHORUS:
bb. Caudal fin lunate, with prominent angles; body covered with blue spots.
e. Body rather deep; preopercle evenly convex, without salient angle; mouth small, lower jaw much projecting; gillrakers slender, long, about x + 20; color carmine, head, back, and sides more or less covered with blue, dark-edged points; caudal tips black; some dark spots on maxillary and about eye; no black blotch on caudal peduncle or on tip of lower jaw .... *dubius*
ee. Body more slender, depth 4 in total length; eye 5.5 in head .... *punctiferus*

105. Bodianus ruber (Bloch & Schneider). *"Fino"; Red Guativere; Ouatilibi.*

Head 2.6; depth 3; eye 5.3; snout 3.8; maxillary 2.1; mandible 1.7; interorbital 6; preorbital 9; D. IX, 15; A. III, 9; pectoral 1.6; ventral 2.1; caudal 1.7; scales about 12–90 to 110–32.

Body elongate, not greatly compressed; mouth moderate; maxillary not extending beyond eye in our specimens; lower jaw projecting; teeth about as in *Petrometopon cruentatus*, depressible teeth smaller; preopercle with weak serrations, its outline convex, with a very slight emargination; opercle with three large, flat exposed spines, and a pointed opercular flap. Scales ctenoid. Dorsal spines slender and sharp, of nearly equal length, save the first and second, which are shorter; caudal truncate; second anal spine somewhat stronger than third, about 3.5 in head; pectoral pointed, reaching far past tip of ventral, 1.7 in head; ventral not reaching vent, 2.1 in head.

Color in life: Body and head rich rosy-red, darkest above, palest on belly; back and sides to lower level of pectoral, as well as head, with numerous small round blue spots, those on head largest; head with a few similar black or darkish spots; dorsal and anal fins blood-red, with black edge; caudal pale-red; pectoral orange-red; ventrals blood-red, with slight black border; inside of mouth flesh-color; two large black spots on tip of lower jaw and two similar black spots on dorsal side of caudal peduncle. In spirits the color is pale-yellowish, in some specimens brownish-gray; the spots mostly remain blue, but some change to gray and brown; caudal dusky, edged with two narrow bands, the inner dark, outer pale, these faded in some specimens.

Two specimens, 8 to 9 inches long, from Arroyo, February 4; called "fino" by the local fishermen. This good food-fish is fairly common throughout the West Indies to Brazil; usually in moderate depths.

Carauna, Marcgrave, Hist. Brasil., 147, 1648, Brazil.
Guativere, Parra, Descr. Dif. Piezas, Hist. Nat., pl. 5, fig. 1, 1787, Cuba.
Gymnocephalus ruber Bloch & Schneider, Syst. Ichth., 346, pl. 67, 1801, Brazil: on *Carauna* of Marcgrave.
Serranus ouatalibi Cuvier & Valenciennes, Hist. Nat. Poiss., 71, 381, 1828, Havana.
Serranus carauna Cuvier & Valenciennes, Hist. Nat. Poiss., II, 384, 1828, Brazil.
Bodianus fulvus ruber, Jordan & Evermann, l. c., 1145, 1896.

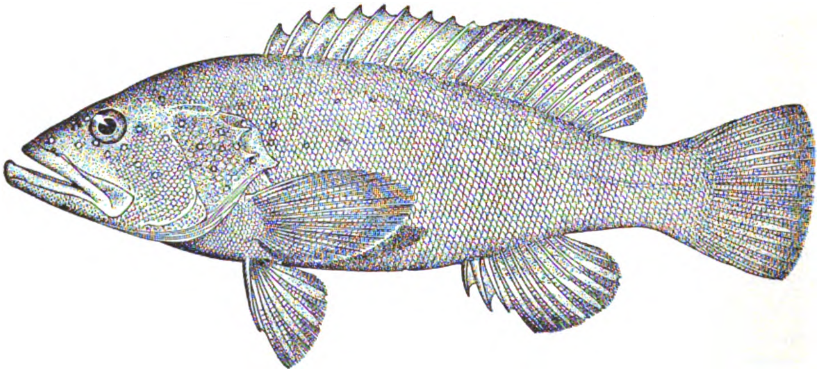

FIG. 43.—*Bodianus punctatus.*

106. Bodianus punctatus (Linnæus). *Nigger-fish; Black Guativere.*

Not differing materially from the preceding, except in color. Color in life, brownish or blackish-olive; spots everywhere on sides and head, dark-blue with light-blue centers; dorsal fin dusky-olive, edged with darker, a few spots on its base; soft dorsal margined with whitish; caudal dusky-olive; anal and ventrals violaceous-black; pectorals olivaceous; the spots in spirits become brown, with gray centers. Length 8.5 to 12 inches.

This species is common in the West Indies, north to Florida. One specimen from Puerto Real and three from San Geronimo. *B. ruber* and *B. punctatus* have usually been regarded as subspecies of *B. fulvus*, but until the fact of intergradation is established it is best to treat them as distinct species.

Perca marina puncticulata, Catesby, Hist. Carolinas, etc., pl. 7, 1743, Bahamas.
Perca punctata Linnæus, Syst. Nat., X, 1758, 291, Bahamas; based on Catesby.
Perca punctulata Gmelin, Syst. Nat., 1315, 1788, Bahamas; after Catesby.
Enneacentrus punctulatus Poey, Fauna Puerto-Riqueña, 319, 1881; Stahl, l. c., 162, 1883.
Bodianus fulvus punctatus, Jordan & Evermann, l. c., 1146, 1896.

Genus 68. EPINEPHELUS Bloch. The Groupers.

Body stout, compressed, covered with small ctenoid scales, which are often somewhat embedded in the skin; scales of lateral line triangular, cycloid; soft parts of vertical fins generally more or less scaly. Cranium narrow above. Parietal crests not produced on frontals, which are without transverse ridge posteriorly; frontals with a process or knob on each side behind interorbital area; premaxillary processes fitting into a notch or cavity on anterior end of frontals. Preopercle moderately serrate behind, its lower limb entire, without distinct antrorse spine; opercle with two strong spines. Nostrils well separated. Mouth large; maxillary large with a well-developed supplemental bone, its surface usually with small scales. Canine teeth few, large in front of jaws; enlarged teeth of inner series of each jaw depressible. Gillrakers short and rather few. Dorsal spines usually 11, rarely 10, not filamentous, last ones somewhat shorter than middle ones. Anal spines 3, second usually the largest; number of soft rays 7 to 9. Caudal fin rounded or lunate. Pyloric cæca few (usually 10–20). Pectoral rounded, shortish, nearly symmetrical, of 15 to 20 rays. Ventrals moderate, inserted below pectorals, close together, each with a strong spine.

Species very numerous, most of them of large size, abounding in all tropical seas, where they are valuable food-fishes. This is the largest and most important genus of the *Serranidæ*, and its species are most widely distributed.

I. SCHISTORUS:

Nostrils unequal, posterior much the larger, three times diameter of the anterior; preopercle with two or three small irregular teeth below its angle; pyloric cæca in increased number; head large.

a. Second and third anal spines about equal in length; color brownish, with about 8 darker crossbands; dark bands radiating from eye; a dark mustache above maxillary; a dark blotch on back of caudal peduncle.. *mystacinus*

II. EPINEPHELUS:

Nostrils subequal, posterior scarcely larger than anterior; pyloric cæca in moderate number.

b. Second dorsal spine short, lower than third or fourth, fin not much notched; caudal rounded more or less; lower opercular spine inserted farther back than upper. Lateral teeth of lower jaw in more than two rows, at least in adult. Interorbital space of moderate width, its breadth more than half diameter of eye and 7 to 10 times in length of head. Dorsal spines 11; preopercle without distinct spinules on its lower limb.

c. Maxillary naked.

d. Lower jaw strongly projecting.

e. Body and head covered with red or orange spots (dusky in spirits and always darker than the ground-color); vertical fins without dark edge, their bases spotted like the body; body with large pale spots besides the orange spots; the young with large black blotches at base of dorsal; angle of preopercle not salient; form robust........ *adscensionis*, 107

ee. Body and head reddish-brown, adult nearly plain, young with darker spots; vertical fins broadly edged with dark brown. Body robust, depth 3 in length. D. XI, 15 or 16. Caudal fin convex behind; maxillary naked; dorsal spines low, subequal; interorbital moderate, 6.5 in head; preopercle with strong teeth at its angle, lower limb entire........ *guaza*

cc. Maxillary more or less scaly.

f. Preopercle with a more or less distinct salient angle, which is armed with teeth (these teeth occasionally undeveloped in *E. striatus*, which species may be known by presence of black points around eyes).

g. Body without orange or dark-brown spots; spots (if any) brownish or pearly, diffuse or irregular; vertical fins without broad black margin.

h. Caudal peduncle without black, saddle-like blotch above. Caudal fin truncate or emarginate when spread open, not convex behind; maxillary usually more or less scaly; vertical fins without broad edging of black; dorsal fin, or a part of it, distinctly edged with bright yellow; color of body uniform reddish-brown, a clear blue streak from eye to angle of preorbital; a faint dark mustache; no black spots anywhere; whole dorsal with a bright-yellow edging; anal and caudal without pale edging; caudal slightly lunate; maxillary scaly; dorsal rays XI, 14; lower jaw strongly projecting (as in *Epinephelus niveatus*, with which this species seems to agree very closely in all respects except color)........ *flavolimbatus*

hh. Caudal peduncle with a large quadrate saddle-like black blotch above (sometimes wanting in *E. niveatus*, especially in the young).

i. Eye not surrounded by dark points; sides brown, marked with large blotches of steel-blue, these more or less regularly arranged and not distinct on breast; no dark crossbars; lower jaw strongly projecting; caudal fin subtruncate, its angles rather acute; pyloric cæca rather numerous........ *niveatus*

ii. Eye surrounded by conspicuous dark-brown points; body with irregular dark crossbars; angle of preopercle little salient; third dorsal spine highest, 2.5 in head; scales moderate, about 100; caudal rounded; lower jaw little projecting; vertical fins in life broadly edged with yellow........ *striatus*, 108

gg. Body covered with small dark-orange or brown spots; lower jaw not prominent; interorbital space very narrow, not half diameter of eye. Vertical fins broadly edged with blue-black, their bases unspotted; body without pale spots, the orange spots rather small; body rather slender; size small........ *guttatus*, 109

ff. Preopercle without salient angle; body, head, and fins dark reddish-brown, profusely covered with small pearly-white stellate spots, body robust; lower jaw projecting; caudal subtruncate, with sharp angles. *drummond-hayi*

bb. Second dorsal spine elevated, not lower than third or fourth; caudal fin lunate; preopercular angle little salient, without enlarged teeth; interorbital width 7 in head........ *morio*, 110

107. **Epinephelus adscensionis** (Osbeck). *Rock-hind; Cabra Mora.*

(PLATE 11.)

Head 2.4; depth 3.2; eye 6; snout 4.3; maxillary 2.3; mandible 2; interorbital 6.7; preorbital 10; D. XI, 17; A. III, 8; pectoral 2; ventral 2.5; caudal 2; scales about 100. Body oblong, robust, somewhat compressed posteriorly; head large, pointed; mouth large, maxillary reaching posterior border of eye, lower jaw strongly projecting; teeth in broad bands, canines in front of lower jaw smaller than those of upper; preopercular margin rounded, with a slight emargination, finely serrate; gillrakers short and thick, 9 + 18; middle opercular spine strong and prominent, lower much smaller and upper not evident without dissection; scales ctenoid; fins rather large, dorsal continuous, with a very shallow notch, spines strong; pectoral broad, middle rays longest, reaching beyond tips of ventrals, equal in length to caudal; ventrals not reaching vent; caudal truncate or gently rounded in younger, adult with margin wavy, due to extension of middle branches of the much-branched rays.

Color in life: Olivaceous-gray, with darker clouds; everywhere covered with round orange-brown or reddish spots, largest and reddest on breast, their centers more orange, borders brown; some scattered whitish blotches; five roundish, ill-defined black blotches along side of back, those under dorsal fin extending upon it and disappearing with age; mouth pale within, roof with red spots; dorsal and anal spotted similarly to body, without dark edge, edge of anal red on anterior rays; ventrals with orange spots; basal half of pectoral colored similarly to dorsal and anal, outer part plain; caudal plain olive with both pale and colored spots at base. In spirits the orange-brown spots become dull-brown.

This fish is widely distributed throughout the western Atlantic from southern Florida to Brazil and is also known from Ascension and St. Helena islands and Cape of Good Hope. At Key West it is very common about rocky elevations in moderately deep water, and is one of the most important food-fishes, reaching a length of 2 feet or more and a weight of 15 or 16 pounds, though the average weight of those brought to Key West does not exceed 2 or 3 pounds. It is caught with hook and line, will take any kind of bait, and exhibits good game qualities. In Porto Rico it is probably common, though we took only two specimens, 10 and 15 inches long, from Ponce and Isabel Segunda.

The rock-hind is one of the most beautiful of our tropical fishes, whether we consider the richness of its colors or the trimness of its form. It bears a strong general resemblance to the red-hind, but its spots are less thickly placed and are larger on some parts of the body.

Perca tota maculis Seba, Thesaurus, III, tab. 27.
Trachinus adscensionis Osbeck, Iter Chin., etc., 1757, English edition, 96, 1771, Ascension Island.
Trachinus punctatus Bonnaterre, Tableau Encycl. Method., 1788, 46; after Osbeck.
Perca stellio Walbaum, Artedi Piscium, 349, 1792; after Seba.
Perca maculata Bloch, Ichthyol., pl. 313, 1792, Martinique.
Trachinus osbeck Lacépède, Hist. Nat. Poiss., II, 364, 1800, Ascension Island; after Osbeck.
Sparus atlanticus Lacépède, l. c., IV, 158, pl. 5, fig. 1, 1803, Martinique; on a copy of a drawing by Plumier.
Serranus nigriculus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 375, 1828, Martinique.
Serranus pixanga Cuvier & Valenciennes, Hist. Nat. Poiss., II, 383, 1828, Brazil; after Marcgrave.
Serranus aspersus Jenyns, Voyage of Beagle, Fishes, 6, 1842, Porto Praya, St. Jago, of the Cape Verde Islands.
Serranus impetiginosus Müller & Troschel, Schomburgk's Hist. Barb., 665, 1848, Barbados.
Serranus varius Bocourt, Ann. Sci. Nat. (5), X, 1868, 222, Gulf coast of Mexico.
Epinephelus punctatus, Poey, Fauna Puerto-Riqueña, 319, 1881; Stahl, l. c., 76 and 162, 1883.
Epinephelus adscensionis, Jordan & Evermann, l. c., 1152, 1896.

108. **Epinephelus striatus** (Bloch). "*Cherna*"; *Nassau Grouper; Hamlet; Cherna Criolla.*

(PLATE 12.)

Head 2.5; depth 3; eye 5.5; snout 4.2; maxillary 2.2; mandible 1.8; interorbital 7; preorbital 10; D. XI, 17; A. III, 8; pectoral 1.8; ventral 2.1; caudal 1.8; scales about 110.

Body rather elongate, of moderate depth, dorsal outline regularly arched, back somewhat compressed; head pointed; mouth rather large, maxillary reaching posterior border of orbit, jaws nearly equal, or lower slightly projecting; teeth in jaws in bands with enlarged patches in front, a pair of canines in front of each jaw, lower pair the smaller; inner teeth of bands enlarged and depressible; preopercle with fine serrations, these enlarged near the angle; opercle ending in 3 flat spines, middle one strongest, upper one scarcely evident; a membranous opercular flap; gillrakers 8+15, counting rudiments; dorsal spines strong, fleshy prolongations of the membrane extending beyond their tips; soft dorsal higher than spinous portion; anal short, high, and rounded; caudal rounded; pectoral large, reaching tips of ventrals, middle rays longest; soft dorsal and anal little scaly; scales of body small, firm and strongly ctenoid.

Color in life: Pale-gray, paler below, side with five or six broad, brown, vertical bars, irregular in shape, the color darker above, extending upon dorsal fin; lower parts of these bars broken by pale blotches and cloudings; a band of same color from snout through eye to dorsal, where it joins its fellow; a narrow median band from snout backward, bifurcating opposite eye, the parallel branches extending to occiput and ceasing abruptly without joining the other band; a quadrate jet-black spot on upper surface of caudal peduncle; some obscure dark bars from eye downward and backward; numerous black points variously placed around and about eye; a narrow brown (in spirits) streak on edge of preorbital, overlapped by maxillary; lower part of side and under parts with whitish spots; dorsal yellow-edged; anal and caudal tipped with orange-yellow; ventrals blackish, tipped with faint yellow; pectorals light-orange or brownish, their bases dusky. The alcoholic specimens have the colors faded variously, some are nearly pale, some nearly uniform brown, and some retain the vertical bars; the square blotch on peduncle and the black points around eye persist in all cases and distinguish this well-marked species from its allies.

This excellent food-fish is found from the Florida Keys southward among the West Indies to Brazil; common about Porto Rico, numerous specimens obtained at San Antonio Bridge, Puerto Real, Ensenada del Boqueron, Ponce, and in the San Juan market; one from San Geronimo. A common and very important food-fish, reaching a weight of 50 pounds or more. The average weight of those brought to the Key West market is less than 10 pounds, while those seen in Porto Rico were still smaller. This grouper is taken with hook and line both about Porto Rico and Key West. It is said to be found at the latter place throughout the year.

Cherna, Parra, Dif. Piezas, Hist. Nat., 1787, 50, lam. 24, Havana.
Anthias striatus Bloch, Ichthyologia, IX, 109, 1792, Martinique.
Anthias cherna Bloch & Schneider, Syst. Ichth., 310, 1801, Cuba.
Sparus chrysomelanurus Lacépède, Hist. Nat. Poiss., IV, 160, 1803, Martinique.
Epinephelus striatus, Poey, Fauna Puerto-Riq., 319, 1881; Stahl, l. c., 76 and 162, 1883; Jordan & Evermann, l. c., 1157, 1896.

109. **Epinephelus guttatus** (Linnæus). "*Mero Guajiro*"; *Cabrilla; Red-hind.*

(PLATE 13.)

Head 2.5; depth 3.2; eye 4.3; snout 4.3; maxillary 2.2; mandible 1.9; interorbital 7.8; preorbital 11; D. XI, 16; A. III, 8; pectoral 1.9; ventral 2.25; caudal 2; scales about 20–100 to 120–x.

Body elongate, somewhat compressed, not so heavy forward as in *E. adscensionis;* head pointed, mouth moderate, maxillary (which is finely scaled) reaching about to posterior border of eye, falling short in young; jaws subequal, lower barely projecting; canines of upper jaw the larger; interorbital space narrow, little more than half eye; preopercle finely serrate, more strongly at angle; a shallow emargination above angle; gillrakers not long, about 17 below angle, counting rudiments; scales ctenoid. Dorsal fin continuous, with a shallow emargination; caudal gently rounded.

Color: In life light yellowish-olive above, whitish or reddish below; three broad, oblique, obscure bands of olive running upward and backward on side; body everywhere with vivid scarlet spots, those above a little darker, those below sometimes with darker centers; some scarlet inside of mouth; soft parts of vertical fins olivaceous and reddish, broadly edged with black, especially dorsal; caudal palest; each with a very narrow white edge; pectoral light-yellow or reddish-orange, with scarlet spots; ventrals red, blackish at tips; inside of mouth red. Another specimen 10 inches long, from Arroyo, showed the following: Body dirty or yellowish-white, profusely covered with round brick-red spots about size of pupil, these darkest above and rosiest red below; these spots somewhat regularly in rows and covering head, lips, and lower jaw; inside of mouth red on sides; tongue white; dorsal olivaceous, with darker and paler areas, edge of membrane at tips of spines rich yellow, elsewhere black-edged; soft dorsal with broad black border narrowly edged with white; anal with six or eight red spots near base beyond which the fin is mottled, then dark like the soft dorsal; pectoral pale-red; ventral with a few pale-red spots, fin purplish-black at tip. In spirits, the oblique bands fade and the scarlet spots become brown.

This species resembles, at least in preserved specimens, *E. adscensionis*, from which it may be distinguished by the scales of maxillary and the broad black edgings of vertical fins. Its range is from the Carolinas southward through the Bahamas and West Indies to Brazil; it is known from Charleston, the Bahamas, Key West, the Bermudas, Havana, Jamaica, Porto Rico, and Martinique. It was obtained by us at Aguadilla, Puerto Real, Arroyo, Isabel Segunda, and Culebra, and by Mr. Gray at San Geronimo.

This is one of the smallest of the groupers, rarely attaining a greater length than 18 inches; it is, however, an important food-fish, and in the Havana market is one of the most abundant species. It is also common at Key West. It is taken by the line fishermen at moderate depths near the coral reefs, and displays good game qualities. Anglers going to Key West or Porto Rico will find the red-hind one of the most beautiful and interesting of the game fishes.

Until recently this species was identified as *E. maculosus* (Cuvier & Valenciennes), but Dr. Günther, in a paper received since the colored plates of this report were printed, shows that the red-hind is evidently the *Perca guttata* of Linnæus. The name on plate 13 should therefore be *Epinephelus guttatus* (Linnæus).

Cugupuguacu brazil, the Hind, Catesby, Nat. Hist. Carolina, etc., pl. 14, 1743, Bahamas.
Cubrilla, Parra, Dif. Piezas, Hist. Nat. Cuba, 1787, Havana.
Perca guttata Linnæus, Syst. Nat., ed. X, 292, 1758, Brazil?
Serranus catus Cuvier & Valenciennes, l. c., II, 373, 1828, Martinique.
Serranus arara Cuvier & Valenciennes, Hist. Nat. Poiss., II, 377, 1828, Havana.
? *Serranus angustifrons* Steindachner, Verh. Ges. Wien, XIV, 1864, 230, pl. VII, fig. 213, Cuba.
Epinephelus cubanus Poey, Repertorio, I, 202, 1867, Cuba.
Epinephelus maculosus, Jordan & Evermann, l. c., 1158, 1896, and 3197, 1900.
Epinephelus guttatus, Jordan & Evermann, l. c., 3197, 1900.

110. **Epinephelus morio** (Cuvier & Valenciennes).

"Cherna"; "Mero"; Cherna Americana; Cherna de Vivera; Nègre; Red Grouper; Jaboncillo.

(PLATE 14.)

Head 2.5; depth 2.7; eye 5.5; snout 4; maxillary 2.1; mandible 1.8; interorbital 7; preorbital 9; D. XI, 16; A. III, 9; pectoral 2; ventral 2.1; caudal 1.7; scales 20–130 to 140–60.

Body deeper than in the other species of *Epinephelus*, and more compressed; head large, pointed, with a large mouth and projecting lower jaw; maxillary reaching past eye; 2 pairs of canines in front of each jaw, lower pair the smaller; preopercle finely serrate, teeth at the angle enlarged, a slight emargination above; dorsal fin with a moderate notch, the spines rather slender, but stiff and sharp, first less than half length of second, which is the longest, 2.5 in head; middle rays of soft dorsal highest; caudal lunate, upper rays produced slightly beyond lower; pectoral reaching beyond tip of ventral, latter not reaching vent.

Color in life: Olive-gray or olive-brown, clouded with pale-olive; lower part of head and breast usually salmon-color, with some red shades; irregular blotches of grayish-white over body; preorbital and adjacent regions with round points of dark orange-brown, becoming brown in spirits; inside of mouth posteriorly bright-orange; iris golden; vertical fins like body, soft parts with a broad edge of blue-black and narrow pale border; spinous dorsal black-edged; ventrals dusky; pectorals light-olive. In spirits, uniform light-brown with pale blotches. With age this species becomes more and more of a flesh red, especially below and on mouth, and the pale spots and blotches become less distinct.

An easily recognizable species, separated from all the others by the elevation of second dorsal spine. Found on the Atlantic coast of America from Virginia to Rio Janiero, and probably common about Porto Rico. Two fine specimens, each about a foot in length, obtained at Puerto Real and Isabel Segunda, where others were seen.

This is a very handsome fish, bearing some resemblance to the Nassau grouper, but the warm browns on the head and side are richer, while the general appearance is somewhat coarser. It is one of the largest and most important food-fishes of our tropical waters. It reaches a length of 2 to 3 feet and a weight of 20 to 25 pounds, or sometimes even 40 pounds. It is very abundant on the west coast of Florida in company with the red snapper. It is most abundant on the south Florida coast and is found throughout the year on the "grounds" at sea, and in the summer in some of the bays. It probably spawns in early spring in both places. Silas Stearns says the young are often seen in Pensacola Bay, where in June he obtained examples about an inch long. The red grouper is more of a bottom fish than the red snapper. It swims more slowly and seldom rises to the surface. It is very voracious, consuming enormous quantities of crustaceans and small fish. Large crabs in almost perfect condition are often found in their stomachs. On the "Snapper Banks" off the west coast of Florida it is caught by the red-snapper fishermen and in the same way, which is with hook and line, a piece of bone-fish or other fish being used as bait. It does not rank high as a game fish, its movements being slow, and when hooked it is hauled up almost as a dead weight. It will take almost any kind of bait. When red snappers were more abundant the red grouper did not find a ready sale in the Northern markets, though it has always been in good demand at Key West and Havana. The maximum weight of those taken at Key West now probably does not exceed 25 pounds and the average is only 8 to 15 pounds.

The red grouper is very tenacious of life, and will live several hours after being taken from the water, even though exposed to considerable heat. This is doubtless one reason why the Key West fishing fleet has preferred groupers for transportation to Cuba, since they are obliged to go a long way to market and through warm water, and the grouper bears the crowding and chafing in the wells of the smacks better than other species.

On the Florida coast this fish is known as the red grouper, or grouper, while in Cuba and Porto Rico it, together with one or two other groupers, is called cherna, cherna de vivera, or jaboncillo.

Serranus morio Cuvier & Valenciennes, Hist. Nat. Poiss., II, 285, 1828, New York and Santo Domingo.
Serranus erythrogaster De Kay, New York Fauna: Fishes, 21, pl. 19, 1842, Florida.
Serranus remotus Poey, Memorias, II, 140, 1860, Havana.
Epinephelus morio, Poey, Fauna Puerto-Riqueña, 319, 1881; Stahl, l. c., 76 and 162, 1883; Jordan & Evermann, l. c., 1160, 1896.

Genus 69. ALPHESTES Bloch & Schneider.

The genus *Alphestes* contains two species of small fishes which differ from *Epinephelus* proper in the presence of a strong antrorse spine on lower limb of preopercle. Frontal bones with an anterior excavation for reception of posterior processes of premaxillaries, a process or knob on each side of skull behind interorbital area; supraoccipital and parietal crests produced on frontals, but not extending to between orbits. Dorsal rays XI, 17 to 20; A. III, 9. Only one of the two species known in Porto Rico.

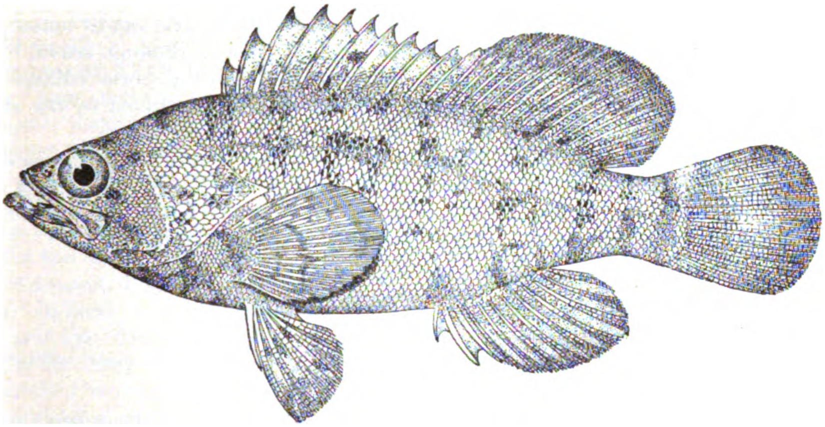

FIG. 44.—*Alphestes chloropterus.*

111. Alphestes chloropterus (Cuvier & Valenciennes). "*Cherna*"; *Guaseta.*

Head 2.6; depth 2.7; eye 4.6; snout 6; maxillary 2.4; mandible 2; interorbital 6.8; D. XI, 18; A. III, 9; pectoral 1.7; ventral 2; caudal 1.6; scales 12-75 to 85-32.

Body ovate and compressed, caudal peduncle short; head small and pointed, anterior profile depressed in occipital region; eye large, its diameter greater than length of short snout; mouth oblique, maxillary reaching posterior border of orbit or beyond; teeth conical and sharp, some of them depressible, in patches on front of jaws, in more than one row on sides; 2 pairs of weak canines on front of upper jaw; lower jaw slightly projecting; preopercle strongly convex, angle rounded, and with a strong, rather flat spine, pointing downward and curved slightly forward; above this are fine serrations along entire upper limb, decreasing in size upward; opercle with 3 flat spines, middle one strongest, upper and lower nearly concealed by scales; scales covering head and body, reduced in size at nape, occiput, and everywhere on head save opercles, where they are rather larger than on body; scales all cycloid save a distinctly ctenoid patch under or above pectoral; gillrakers short, about 15 below angle; dorsal fin continuous, with a shallow notch, spines strong and pungent, fourth and fifth highest, 2.5 in head; soft dorsal as high as spinous, about the fourteenth ray longest, 2.25 in head, fin pointed posteriorly, rounded in young; anal high, second spine strongest and about equal to third, 2.7 in head; caudal rounded; pectoral and ventral subequal, not reaching vent; in a small individual (4 inches) the pectoral reaches past ventral, which just reaches vent.

Color in life: Body yellowish-brown, paler below, upper part of side with about 7 longitudinal stripes of dark brown from head to tail, these becoming rows of round orange spots below; 6 dark, inconspicuous, vertical body bars; head with many smaller orange-brown spots; lower part of head and breast with pale-bluish spots; fins brownish; soft dorsal with oblique bars of black; spinous dorsal olive, blotched with brown; ventral olive, edged with darker; other fins obscurely barred; inside of mouth pale.

Found in the West Indies, Cuba to Brazil; also recorded from Africa and the Falkland Islands; not known from Florida; apparently not uncommon about Porto Rico. Two females, 7.5 and 9.5 inches long, respectively, and each with well-developed roe, were obtained in the San Juan market January 17. Another specimen, 4 inches long, was gotten at Mayaguez. The species reaches a length of a foot or more and is a food-fish of importance. The only local name heard for it was "cherna."

Plectropoma chloropterum Cuvier & Valenciennes, Hist. Nat. Poiss., II, 398, 1828, Santo Domingo and Martinique.
Plectropoma monacanthus Müller & Troschel, in Schomburgk's Hist. Barbados, 665, 1847, Barbados.
Alphestes afer, Jordan & Evermann, l. c., 1164, 1896.

Genus 70. MYCTEROPERCA Gill.

Cranium broad and transversely concave between eyes, its lateral crests very strong, nearly parallel with supraoccipital crest and extending much farther forward than latter, joining supraocular crest above eye, supraoccipital crest not extending on frontals; frontal bones without anterior concavity or notch for reception of premaxillaries, without processes on the upper surface; lower jaw strongly projecting; anal fin elongate, with 11 or 12 (in one species 9 or 10) soft rays; caudal lunate; spines of fins slender, none of them much elevated; scales small, mostly cycloid, those on lateral line simple; pyloric cæca few; gillrakers various; nostrils small, and subequal or with posterior enlarged. Otherwise essentially as in *Epinephelus*, from which genus *Mycteroperca* is well separated by the structure of the skull, and superficially by longer anal, larger mouth, and more elongate body.

Large, handsome fishes of the Tropics, mostly American, including some of the most valuable food-fishes in the Gulf of California and at least six of the valuable species of the Florida coast. Of the 20 or more American species only 2 are thus far known from Porto Rico. All are excellent for food, and those found where fisheries have become established are much sought.

a. Nostrils subequal, well separated; scales on head cycloid.
b. Gillrakers comparatively few and short, 8 to 20 below angle of arch.
TRISOTROPIS:
c. Anal rays III, 11 or III, 12, the fin long.
d. Anal fin not angulated, its outline more or less evenly rounded in adult as well as in young; soft parts of vertical fins edged with black in life.
e. Angle of preopercle not salient, its teeth scarcely enlarged; gillrakers x + 8 to 10.
f. Gillrakers very few and short, x + 8 developed (besides some rudiments); general color pale, bright red or grayish, with roundish spots or blotches of black or red darker than the ground-color; the blacker blotches along middle of sides much larger and quadrate in young; red always present somewhere in life (fading in spirits); pectorals blackish, in the adult broadly tipped with orange-yellow; scales rather small (about 125), caudal lunate.
g. General color gray, with red and black markings .... *venenosa*
gg. General color scarlet, with red and black markings .... *apua*
ff. Gillrakers rather slender, about x + 10 (besides several rudiments); caudal subtruncate; nostrils small.
h. Scales not very small (about 110); color dark olive-green; sides of head and body with rivulations of dark-bluish around roundish dark-bronze spots, large or small (these markings subject to considerable variation, fading in spirits); sides with darker quadrate areas.
i. Dark blotches on body rather large, often quadrate .... *bonaci*, 112
ii. Dark spots on body very small, close-set, of a deep-bronze orange .... *xanthosticta*
ee. Angle of preopercle more or less salient, its teeth somewhat enlarged; gillrakers more numerous, x + 12 to 14.
j. Scales not very small (about 110); upper part of body dark-brown, lower half abruptly paler; a pale ring around caudal peduncle, behind which is a squarish dark blotch, smaller than eye, at base of upper rays of caudal; caudal deeply lunate; teeth strong .... *dimidiata*
PAREPINEPHELUS:
bb. Gillrakers close-set, very long and slender, 25 to 35 below angle of arch.
k. Caudal fin lunate, its angles more or less produced in adult, fin subtruncate in young; anal fin more or less angulate in adult, rounded in young; soft dorsal somewhat angular; scales rather large (lateral line 95); body rather deep, snout sharp; preopercle with a salient angle which is armed with larger teeth; dorsal spines low; gillrakers close-set, x + 30, longest 7.5 in head; ventrals not reaching to vent; color olive-gray, with darker reticulations around pale spots; fins not much darker on their edges; a dark mustache along maxillary; adult examples nearly uniform brown; not known to be red .... *rubra*
aa. Nostrils very close together, posterior decidedly larger than anterior, and with a more or less distinct horizontal cross-septum within; scales on head cycloid.

MYCTEROPERCA:

l. Gillrakers moderate, fewer in number, 6 to 18 below angle of arch.
m. Second dorsal spine low, shorter than third, the third and fourth highest.
n. Margin of anal fin posteriorly concave, its middle rays much exserted.
o. Gillrakers rather numerous, 17 to 20 below angle of arch.
p. Outer rays of caudal much produced, more than two-thirds length of head; preopercle with salient angle; canine teeth strong; scales small (140); gillrakers about 4 + 20. Color brownish, with small darker spots; vertical fins broadly edged with blackish.
q. Upper canines directed strongly forward, lower backward; coloration obscure.............................. *falcata*
qq. Upper canines nearly vertical; coloration paler and brighter.............................. *phenax*
nn. Margin of anal fin not concave posteriorly, outline of fin rounded or slightly angular.
r. Gillrakers rather few, x + 12; body without dark crossbars, covered with grayish reticulations around small round spots, these not evident on head; anal fin rounded; preopercle with a salient angle; form rather robust; anal fin not angulate.
s. Scales very small, about 20–140–37; caudal not deeply lunate; eye small.............................. *bowersi*, 113
ss. Scales larger, about 90 to 100 in lateral line; caudal deeply lunate; eye larger.............................. *calliura*
rr. Gillrakers very few, short, and thick, about x + 6; body olive or (var. *camelopardalis*) bright red, with light and dark crossbars, these often becoming obsolete with age; head usually with distinct reticulations around yellowish spots; anal fin with angular margin, subtruncate posteriorly; preopercle without salient angle; scales rather small (lateral line 133); form rather robust.
t. Ground-color dark-olive.............................. *tigris*
tt. Ground-color bright-red.............................. *camelopardalis*

112. **Mycteroperca bonaci** (Poey). *Aguaji; Bonaci Acara; Black Grouper.*

Head 2.75; depth 3.25; eye moderate, 6 in head (young); D. XI, 16 to 18; A. III, 11 or 12; scales 18–120 to 125–50, pores 70 to 85. Body comparatively slender, a little more robust than in *M. microlepis*, its breadth 2.33 in its depth; head moderate, rather pointed, its anterior profile little curved; mouth rather large, maxillary reaching slightly beyond eye, 2.2 in head (in young), proportionately longer in adult; maxillary with cycloid scales. Teeth in rather narrow bands; two rather strong canines directed little forward in front of each jaw. Interorbital space slightly convex, its width 6 in head. Preopercle forming a regular curve without salient angle, emargination near angle very slight. Nostrils small, roundish, subequal; not very close together, Gillrakers few and long, 10 to 12, besides rudiments on lower part of anterior arch. Scales rather small, chiefly cycloid; dorsal spines comparatively slender and weak, outline of fin gently convex; tenth spine about as long as second; third and fourth spines longest, 3.33 in head; caudal fin truncate when spread open, its outer rays a very little produced, 1.6 in head; anal rather high and rounded, its longest rays 2.25 in head; pectoral reaching slightly beyond tips of ventrals, 1.7 in head. Ventrals short, not reaching vent. Pyloric cæca 15.

Color in life: Deep orange-brown, more olive on back, clouded above by paler or grayish; sides and belly marked everywhere by reticulations of pearly gray, which surround roundish or oblong spots of ground-color, pale streaks being largely horizontal on sides; sides of head similarly marked, the spots smaller, bronze-brown, reticulations decidedly bluish; 6 or 7 spots in a straight line between eye and preopercle, having nearly the diameter of the pupil; spots on body mostly covering 4 to 6 scales, all of them larger than a scale; dorsal olive-brown, somewhat mottled; caudal similar to dorsal, narrowly edged with whitish; anal similar with 2 or 3 rows of bluish spots, its tip blackish, with a narrow whitish edge; pectorals olive-brown, plain; ventrals blackish, rays bluish. Mouth not green, lips olive, barred with bluish; iris reddish. Here described from a specimen 11.5 inches long, from Key West. A large specimen, about 2.5 feet in length, seen at Key West, retained the same general coloration, the bronze spots and rivulations being distinct and not smaller than in young.

In spirits the orange-brown of the body is replaced by dark-brown, and the blue reticulations of the head by gray; all the markings become more faint.

This fish ranges from Florida to Brazil. It is common at Key West, where it is called black grouper. Probably not uncommon about Porto Rico, though seen by us only at Puerto Real. It is one of the important food-fishes of Key West and is probably held in equal esteem in Porto Rico. It reaches a length of 2 to 3 feet and a weight of 50 pounds. The larger individuals are caught with the hook, but the young are often seined along the shore.

Serranus bonaci Poey, Memorias, II, 129, 1860, Cuba.
Serranus brunneus Poey, Memorias, II, 131, 1860, Havana.
Serranus decimalis Poey, Memorias, II, 138, 1860, Cuba.
Serranus cyclopomatus Poey, Memorias, II, 353, 1861, Cuba.
Serranus latepictus Poey, Memorias, II, 353, 1861, Cuba.
Trisotropis aguaji Poey, Repertorio, 229, 1868, Havana.
Mycteroperca bonaci, Jordan & Evermann, l. c., 1174, 1896.

113. **Mycteroperca bowersi** Evermann & Marsh, new species.

"Rock-hind"; "Rock-fish"; "Mero Cabrilla."

Head 2.8 measured from tip of upper jaw; depth 3.4; eye 7.5; snout 3.7; maxillary 2.1; mandible 1.7; interorbital 4.6; preorbital 8.4; scales about 20–140–37; D. xi, 16; A. iii, 11; P. 17; gillrakers x + 10.

Body rather long, compressed, the dorsal and ventral outlines each gently and regularly arched; head long and pointed, the greatest width 2.25 in its length; snout long; mouth large, lower jaw strongly projecting and entering in profile of snout; maxillary reaching far beyond the orbit; supplemental maxillary bone evident; eye small, high up; preopercle very finely serrate, slightly concave at its angle; opercle ending in a long flat point upon base of which is a broad, flat spine; nostrils close together, posterior much the larger, with an anterior horizontal cross-partition at base. Fins rather low; origin of dorsal over end of opercular flap; first dorsal spine short, equal to diameter of orbit; second spine somewhat exceeding twice length of first; third, fourth, and fifth spines longest, subequal, about a third longer than second, or 3.35 in head; soft dorsal rounded, its longest rays about 3 in head; caudal slightly lunate, outer rays 1.7 in head; anal rounded, spines slender and weak, longest (third) 2.6 in head, longest ray 2.6; pectoral rounded, middle rays longest, 2.2 in head; ventral 2.4. Scales small, thin, and cycloid, those on head and nape very small and embedded.

Color in life: Body dark reddish-brown, covered with many small, round, blood-red spots, these also on head, lower jaw, and base of pectoral and anal, especially numerous on anal, and a few on spinous dorsal; soft dorsal mottled with white and black, bordered with a very narrow white edge inside of which is a broad black band; tip of caudal narrowly white, then a broad black band, rest of fin mottled with white and black; anal similar to soft dorsal, but with more red spots; pectoral crossed by two broad dark bars, outer end of fin yellow; inside of mouth pale red. In alcohol the general color becomes dark-grayish, paler below; red spots changing to black or dark-brown.

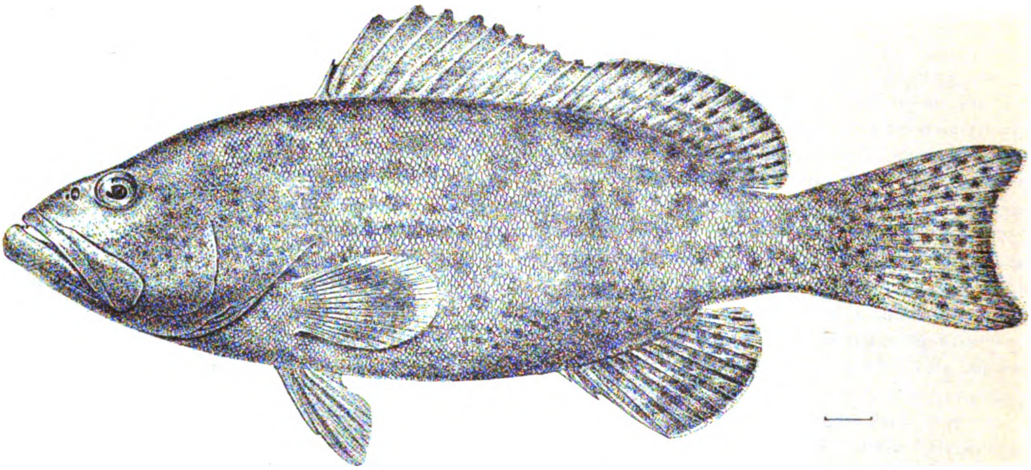

FIG. 45.—*Mycteroperca bowersi.*

Judging from descriptions this species appears to be related to *M. calliura* Poey, but differs in a number of important particulars, among which are the smaller scales, smaller eye, and very different coloration. According to Poey, *M. calliura*, in life, was dark brownish-olive, with rounded yellowish spots; fins dark-brown, darker on edges of vertical fins; eight narrow, dusky crossbands on body; caudal with a beautiful green crossband; pectoral yellowish toward the center, the posterior margin green.

Only a single specimen (type No. 49530, U.S.N.M.) of this important species was obtained. This is 21.5 inches long and was purchased from a Tortola fisherman at Culebra Island, February 10. It was called by him "rock-hind," "rock-fish," or "mero cabrilla," and was caught, along with the tangs, angel-fish, and other species, in a fish-trap of the style in common use about Culebra Island. Though no others were seen, the species seems to be well known to the fishermen about Culebra and Vieques islands, and is held in high esteem as a valuable food-fish.

We name this species for the Hon. George M. Bowers, U. S. Commissioner of Fish and Fisheries.

Genus 71. DIPLECTRUM Holbrook. The Squirrel-fishes.

This genus is very close to *Prionodes*, from which it differs chiefly in the armature of preopercle, which is provided in adult with one or two clusters of strong, straight, divergent spines. Smooth area on top of head, as in *Serranus*, large, extending backward to a line connecting borders of preopercle; supraoccipital and parietal crests very short; preorbital broad; maxillary widest before its tip; profile of snout rounded; pectoral unsymmetrically rounded, its upper rays longest; ventrals inserted somewhat before axil of pectoral; dorsal spines slender, none of them much elevated; soft dorsal short, rays x, 12; anal rays III, 7; caudal lunate.

Species of small size and bright colors, all American; only one species known from Porto Rico, but *D. formosum* also doubtless occurs there.

HALIPERCA:

a. Preopercle with a single center of divergence of the spinules about its angle (in adult as well as in young).

b. Gillrakers moderate, about 10 below angle of arch; spines on produced portion of preopercle numerous, 8 to 20 in number; outline of spinous dorsal fin somewhat convex, so that the fin is more deeply notched than in *Diplectrum formosum;* jaws equal; vertex naked; opercle black within.

c. Scales on cheek small and regularly placed, in about 10 rows; 22 scales before dorsal.................. *radiale*, 114

DIPLECTRUM:

aa. Preopercle with 2 clusters of divergent spines, one at angle, other higher (the 2 fascicles well separated in adult, but smaller and coalescent in young).

d. Head and body marked with many interrupted blue lines; preorbital broad, more than twice width of maxillary; lower half of preopercle with strong, straight spines diverging from two centers; gillrakers short and small, x+14; 11 rows of scales on cheek; caudal deeply lunate, upper lobe the longer, sometimes ending in a long filament. Color brownish, silvery below; side with 7 or 8 longitudinal deep-blue lines and about as many dark crossbars, last bar forming a large black blotch at upper base of caudal; young with 2 broad, dusky longitudinal stripes, which become interrupted with age; 3 or 4 distinct blue stripes on sides of top of head; 2 across preorbital, the lower forked; fins with narrow, wavy bars of blue and pale yellow.................... *formosum*

114. Diplectrum radiale (Quoy & Gaimard). *Aguavina.*

Head 2.8; depth 3.8; eye 3.75; snout 3.8; maxillary 2.1; mandible 1.9; interorbital 4.6; preorbital 9; D. x, 12; A. III, 7; pectoral 1.5; ventral 1.7; caudal 1.35; scales 7–70–18.

Body elongate, dorsal and ventral outlines nearly alike save for a depression at nape; head pointed, a large, smooth round area above, behind eyes; lower jaw barely projecting; teeth chiefly in one row on sides of jaws, in small patches in front; maxillary reaching posterior edge of pupil; eye large, placed high in head; about 9 rows of regularly placed scales on cheek; preopercle with a strongly salient angle composed of radiating spines; opercle with 7 or 8 rows of scales. Dorsal fin continuous, slightly notched, spines slender and very sharp; caudal lunate, upper lobe very slightly produced. Scales strongly ctenoid.

Color in spirits: Olive, paler below; many faint vertical dark bars wider than interspaces, plainest at middle of sides; 2 faint longitudinal dark bands, first from shoulder to soft dorsal, other from nearly same origin to base of caudal, where it forms a faint dark spot; some faint, pale streaks on preorbital and cheek. In life, the soft dorsal has blue spots encircled by darker blue rings; caudal barred with similar spots; body light-brown above, yellowish below, sides salmon-color, head and fins with red shadings.

Found on both coasts of tropical America, north to Havana and Guaymas; very common on the coast of Brazil and in the Gulf of California, usually in shallow bays; apparently not common in Porto Rico, where one young individual, 5 inches in length, was collected at Mayaguez.

Serranus radialis Quoy & Gaimard, Voyage Uranie, 316, 1824, Rio Janeiro.
Serranus bivittatus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 241, 1828, Martinique.
Centropristes ayresi Steindachner, Ichth. Notizen, VII, 1, pl. 1, fig. 1, 1868, Santos, Brazil.
Diplectrum radiale, Jordan & Evermann, l. c., 1204, 1896.

Genus 72. PRIONODES Jenyns. Serranos.

Body oblong, moderately compressed, covered with moderate-sized ctenoid scales. Lateral line normal in direction, not running close to back. Cranium above with a very large convex smooth area, which is longer than the low supraorbital crest; supraoccipital and parietal crests short, extending to a line connecting borders of preopercle; posterior outline of cranium nearly vertical in profile; mouth large, maxillary not scaly and without supplemental bone; canines small, lateral; no depressible teeth in jaws; teeth always present on vomer and palatines. Gillrakers usually few. Branchiostegals 7. Dorsal with 10 rather slender spines either subequal or one of them much produced, the fin not deeply notched, the soft portion short, of 11 to 13 rays, and nearly or quite destitute of scales; anal short, with slender spines; caudal lunate or truncate. Ventrals not very close together, inserted somewhat in advance of pectorals, as in *Centropristes* and *Diplectrum*. Vertebræ 10 + 14 = 24.

Species of small size, probably all American, closely allied to the Old World genus *Serranus*, from which they are distinguished by the short, naked, soft dorsal, the anterior insertion of ventrals, and the smaller teeth. Of the 11 known American species only one has been found in Porto Rico. At least two other species (*P. phœbe* and *P. tabacarius*) probably occur there.

PRIONODES:
a. Scales large, 42 to 55 in the lateral line.
b. Scales on cheek very large, in about 5 series; dorsal spines not quite equal, fourth longest, about twice length of ninth.
c. Teeth unusually strong, 3 or 4 on each side in upper jaw as large as largest lateral teeth; jaws equal; preorbital extremely narrow, not one-third width of pupil; preopercle very sharply serrate; gillrakers short, slender, x + 10; caudal forked. Color plain-olivaceous; fins all pale; sides with about 6 faint dark crossbands, more or less confluent along lateral line .... *fusculus*
bb. Scales on cheek moderate, in about 8 series; body oblong, heavy anteriorly; dorsal outline a little elevated, profile almost straight; lower jaw not projecting; canines small; mouth large; preorbital narrow; dorsal fin not notched.
d. Eye large, equal to snout; gillrakers short, x + 10; caudal deeply lunate; pectoral long. Color light-brownish, with lighter blotches and faint dusky bars; a very conspicuous, sharply defined, vertical white bar extending upward on each side from just before vent; fins pale .... *phœbe*
dd. Eye very large, greater than snout; gillrakers short, x + 6; caudal truncate. Color, upper parts scarlet, lower parts bluish-white; a yellow lateral band, under which are 4 quadrate black blotches .... *baldwini*, 115
MENTIPERCA:
aa. Scales small, lateral line with 60 to 75 in its course.
e. Lower jaw not very strongly projecting.
f. Body covered with irregular, inky-black spots and bands. Body long and low, head low and sharp, lower jaw projecting; scales on cheek in 10 or 12 rows; teeth small; gillrakers very short, x + 7; dorsal low, not notched; caudal forked. Color brownish above, sides yellowish, everywhere above, below, and on fins covered with irregular inky-black spots, blotches, and bands, latter meeting around belly; pectorals and anal plain; a broad ring around base of caudal, and many irregular spots around bases of ventrals and pectorals; numerous black spots on dorsals and caudal, one of those on front of spinous dorsal very conspicuous .... *tigrinus*
ff. Body not covered with conspicuous inky-black spots and bands.
g. Back with 3 or more large, conspicuous blotches of yellowish-white. Body more elongate than in related species; lower jaw slightly projecting; scales on cheek in 11 series; dorsal spines low, fifth the longest, 2.25 in head; caudal strongly lunate; pectoral and ventrals short. Color brownish-red above, with areas of light yellow on sides of back; one before dorsal; a large one and a small one below spinous dorsal; a large one below last rays of soft dorsal; one on back of tail; top of head with 2 pale cross-shades, one before, one behind eye; lower fins light-orange; caudal red, with 2 conspicuous longitudinal stripes of blackish-red; dorsal red-shaded, a maroon blotch on each part of it extending upward from a similar blotch on back .... *tabacarius*
gg. Back without conspicuous blotches of yellowish-white.
h. Coloration nearly uniform; body elongate; snout short and thick; caudal slightly lunate. Color brownish-yellow on back, orange on sides, and brighter or red on belly; no spots nor bands; upper part of head bluish, fins gray; caudal bordered above and below with brown .... *flavescens*
ee. Lower jaw very strongly projecting; body elongate, moderately compressed; scales small, about 70; snout sharp, much longer than the large eye; preopercle finely denticulated; top of head with vertex naked; caudal deeply forked; skull depressed, with a single crest; dorsal spines moderate, third highest.
i. Color clear brown with larger darker spots or bars on sides; fins pale, more or less tinged with orange. *lucioperca*nus

115. **Prionodes baldwini** Evermann & Marsh.

(PLATE 15.)

Head 2.5; depth 3.2; eye 4; snout 4.6; maxillary 2.4; mandible 2; interorbital 7; D. x, 12; A. III, 7; pectoral 1.4; ventral 1.3; caudal 1.7; scales 4–42–12.

Body elongate, moderately compressed, not elevated, covered with ctenoid scales; dorsal and ventral outlines alike; head moderate, pointed, naked above and below; eye large, greater than length of snout, high in position; mouth terminal, slightly oblique, maxillary reaching middle of eye or somewhat beyond; gillrakers short, 6 developed on lower limb; teeth small, conical, and sharp, on vomer and palatines and in several series in each jaw, with weak canines in front and a few canine-like teeth on middle of side of lower jaw; cheek with about 7 rows of scales; preopercle finely serrate; opercle ending in 3 sharp, flat spines, middle one largest, a membranous pointed flap projecting beyond; fins all naked, dorsal continuous, with a slight emargination; spines slender and pungent, first 4 or 5 graduated, rest subequal, 3.2 in head, lower than soft rays which are contained about 2.5 in head; anal fin short, second spine longest and strongest, 3 in head, soft part high, fifth or sixth ray longest, reaching almost to front of anal, 2 in head; ventral with second ray produced, reaching vent; caudal truncate, or with middle rays very slightly shorter, making the margin slightly concave.

Color in life: Dorsal half of head and trunk and all of caudal peduncle scarlet, ventral portion pale-blue, almost white; a yellow longitudinal band, nearly as wide as pupil, from preopercular margin straight across opercle and along body to lateral line under last dorsal rays; 4 quadrate or oblong black blotches just under this band, the first about under middle of spinous dorsal, second under last spines, third under first rays, fourth under last rays; from each of the first three of these blotches a square, well-defined yellow shade extends downward to belly or base of anal, a similar one from base of pectoral to ventral; 4 smaller black blotches at base of caudal, 2 others, somewhat larger than the last, just in front of them on caudal peduncle; a row of 9 round black dots on each side at base of dorsal fin, first one smallest, opposite membrane of first spine, the other 8 separated somewhat obscurely into pairs, the first pair under middle spines, second under last spines, third under first rays, fourth under last rays; 2 or 3 very small black dots on upper edge of caudal peduncle; 2 or 3 more in front of dorsal on median line, each accompanied by a similar one on either side; in some specimens a few scattering ones on top of head behind eyes, sometimes regularly arranged; a few dark-brown spots behind eye; various dark markings on side of head, without very definite pattern, but usually 2 oblique stripes on cheek, a heavy black blotch on interopercle and 2 on ramus of mandible, which, with their fellows of the other side, make distinct crossbars on lower side of head, usually extending across maxillary; chin and lower part of opercle with dark spots; lateral line white, with a few broken spots, comparatively faint, just below it; iris red, with an inner ring of white surrounding pupil; spinous dorsal pale, edge of membrane black, this color bordered below with faint yellow; soft dorsal pale, spotted throughout with light-orange, with a marginal band of same, outside of which is a very narrow pale-blue edge; ventral very pale-blue, produced ray somewhat yellow; anal pale-blue with some light orange on last rays; pectoral and caudal uniform pale-reddish, unmarked.

In spirits, all the red and yellow markings disappear, the dark persists, and additional markings are brought out as follows: Along anterior and upper part of the trunk and crossing the lateral line are dark-brown vertical bars, diffuse and running together, or separated and broken into round or quadrate blotches; in the middle part of the course of yellow longitudinal band appears a row of very small black points; spots on soft dorsal dusky; dark mottlings on caudal; upper and lower base of pectoral, and sometimes axil, dusky.

A beautiful and strongly marked species; 2 specimens dredged and 33 others, ranging in size from 0.55 to 2 inches, caught in the tangle, off Culebra and Vieques islands, on coral bottom, in depths of 15 and 16 fathoms. Known only from Porto Rico.

This interesting species was "named for Mr. Albertus H. Baldwin, the artist of the expedition, in recognition of his excellent drawings and paintings of American fishes."

Prionodes baldwini Evermann & Marsh, Report U. S. F. C. for 1899 (December 19), 353, Fish Hawk station 6093, off Culebra Island, 5.25 miles southwest of Culebritas Light-House, February 8, 1899, in 15 fathoms.

Genus 73. DULES Cuvier.

This genus is close to *Prionodes*, differing in having but 6 branchiostegals and in the truncate form of the caudal fin. In *D. auriga* the third dorsal spine is prolonged in a whip-like spine. There are 3 known species of the genus, the one described below and *D. subligarius*, which occurs on the South Atlantic coast of the United States, and *D. auriga*, from the coasts of Brazil and Uruguay.

a. Third dorsal spine not longer than fourth, 3 in head; second anal spine considerably longer than third, about 2.25 in head; lower jaw little projecting; gillrakers short and few, 6 or 8 in number; jaws scaleless; soft dorsal with small scales; pectoral long, reaching anal. Color brown, with darker cross-shades; soft dorsal, anal, and caudal fins checkered with blackish on a white ground; a broad white area or bar before anal fin.

b. Dorsal rays x, 13; head small, acuminate; pectoral fin finely barred with black and whitish, precisely like caudal fin; a very conspicuous inky-black blotch on front of soft dorsal (at least in the young), this being a continuation of one of the bars on body; a black ring about tail at base of caudal, before which are 6 or 7 dark bars, becoming progressively broader and fainter forward; lower parts of head with a conspicuous network of dark streaks.. *subligarius*

bb. Dorsal rays x, 12; head less slender; pectoral red; inky blotch on soft dorsal small or obsolete; dusky bars on body distinct.. *dispilurus*, 116

aa. Third dorsal spine in adult male greatly elevated, reaching past middle of soft dorsal, its length quite variable; second anal spine as long as third, 2.83 in head; lower jaw prominent; gillrakers 10 to 12 below arch; pectoral shorter than head; brownish lower parts with light and dark shades; fins clouded.................... *auriga*

116. **Dules dispilurus** (Günther).

Head 2.4; depth 2.75; eye 4.2; snout 4.2; maxillary 2.3; mandible 1.9; interorbital 7; D. x, 12; A. III, 7; pectoral 1.35; ventral 1.6; caudal 2; scales 5–44–12.

Body oblong, of moderate depth, considerably compressed; mouth large, slightly oblique, maxillary reaching center of large eye or beyond; teeth in villiform bands in each jaw, in lower becoming uniserial posteriorly; a few enlarged teeth in outer row of both jaws; vomer and palatines with narrow bands of villiform teeth, some of them enlarged; jaws subequal; preopercle evenly rounded, finely serrate above; opercle with 3 pungent spines, middle one longest; scales rather large, ctenoid; caudal fin truncate; second anal spine longest and more or less curved.

Color in spirits: Brownish, some specimens more olive; 5 or 6 crossbands of darker color on body, not very distinct, these extending on dorsal fin, where they are quite black and sharply defined—1 on front of spinous dorsal, 1 on last spines, and 1 on first dorsal rays at height of last dorsal spines, the bar from this one extending to about lateral line only; another at base of last dorsal rays. Between these inky-black blotches are much smaller spots not parts of the body bars; caudal peduncle with 1 or 2 vertical bars; an oval black spot, smaller than pupil, at base of upper caudal rays, and 1 at base of lower, with fainter markings between; caudal and anal mottled, ventrals dark, pectoral pale (red in life); many (about 15) longitudinal brownish or olive lines on body, formed of color on upper and lower edges of scales, rather wider than interspaces, and giving the fish its general color; a faint, wider, dark streak from occiput to upper edge of eye, and 1 from shoulder through eye to tip of snout. A creamy quadrate blotch from belly, in front of vent, extending upward about halfway to lateral line, its posterior border more sharply defined than anterior.

A strongly marked species heretofore known only from Trinidad and Jamaica. Five examples, one about 1.75 inches, the others 2.75. The smaller one was taken with the tangle, off Point Melones, in 7 fathoms; one of the others in the beam trawl, 9 miles from Mayaguez, in 220 fathoms, on rocky bottom; the others were seined at Mayaguez.

Centropristis dispilurus Günther, Proc. Zool. Soc. Lond., 1867, 99, Trinidad.
Dules dispilurus, Jordan & Evermann, l. c., 1219, 1896.

Genus 74. RYPTICUS Cuvier. The Soap-fishes.

Body oblong, compressed, covered with very small, smooth, embedded scales. Lateral line normal, head scaly. Mouth rather large, oblique, lower jaw the longer; maxillary with a supplemental bone, as in *Epinephelus*, with which this genus agrees in general osteology; smooth area on top of cranium very large, transversely convex, much longer than supraoccipital crest; interorbital area very narrow; parietal and supraoccipital bones short, with feeble crests, which do not extend on frontals; premaxillaries reaching frontals, which have a fossa in front; teeth all villiform, in bands on jaws, vomer, and palatines; preopercle crescent-shaped, without angle or serratures, but provided with 2 or 3 spinous hooks on the posterior margin; opercle with 2 or 3 spines; gillrakers short; branchiostegals 7. Dorsal fins separate, the first of 2 or 3 (rarely 4) small spines, second of many (about 25) soft rays; anal long, rounded, of soft rays only; caudal rounded; pectoral rounded, nearly symmetrical, of 17 rays; ventrals small, I, 5, inserted slightly before pectorals, the spine short and strong. Vertebræ 10 + 14 = 24. Skeleton generally similar to that of *Epinephelus*.

Species about 8, all from the seas of tropical America.

RYPTICUS:
  a. Dorsal spines 2 or 3 (rarely 4).
  b. Preopercle with two spines only, lower scarcely the longer.
  c. Opercular spines 3, all well developed.
  d. Color not red, chiefly olivaceous; dorsal fins distinctly connected by membrane.
  e. Eye not longer than snout; pores in lateral line 85 to 90........................ *saponaceus*, 117
  ee. Eye longer than snout; pores in lateral line 67; brownish, with blackish spots and dots........ *arenatus*
  cc. Opercular spines 2, small, uppermost the smaller........................ *coriaceus*, 118
PROMICROPTERUS:
  bb. Preopercle with 3 spines........................ *bistrispinus*, 119

117. **Rypticus saponaceus** (Bloch & Schneider). *Soap-fish.*

Head 3 to 3.33 in length; depth 2.6 to 3.25; D. III, 23 to 25; A. 16 or 17; scales 85 to 90 (pores). Body comparatively deep, young more slender; back elevated, snout rather pointed; lower jaw much projecting; anterior profile before eye little concave; eye 4.5 to 5 in head; maxillary reaching posterior edge of eye, 2.12 in head; preopercle with 2 straight spines behind; opercle with 3 spines, middle one largest and nearer upper than lower; first and second dorsal spines subequal, third smallest; dorsals slightly connected, ventrals very small, not half longer than eye; pectoral rounded; gillrakers very small and short, about 8 developed. Color dusky-brown, fins marked with blackish and usually with a narrow pale edge; sides generally with irregular pale spots; back and head usually immaculate.

West Indies, Pensacola to West Africa and Brazil; generally common. The best known and most widely distributed of the soap-fishes. Though not obtained by us in Porto Rico, we include it on the authority of Poey.

Jaboncillo, Parra, Dif. Piezas Hist. Nat., 51, pl. 24, fig. 2, 1787, Havana.
Anthias saponaceus Bloch & Schneider, Syst. Ichth., 310, 1801, Havana; after Parra.
Rhypticus microps Castlenau, Anim. Nouv. et Rares, 6, 1855, Bahia; after *Perca microps* Broussonet, a MS. name.
Rhypticus saponarius, Poey, Fauna Puerto-Riqueña, 322, 1881; Stahl, l. c., 76 and 162, 1883.
Rypticus saponaceus, Jordan & Evermann, l. c., 1232, 1896.

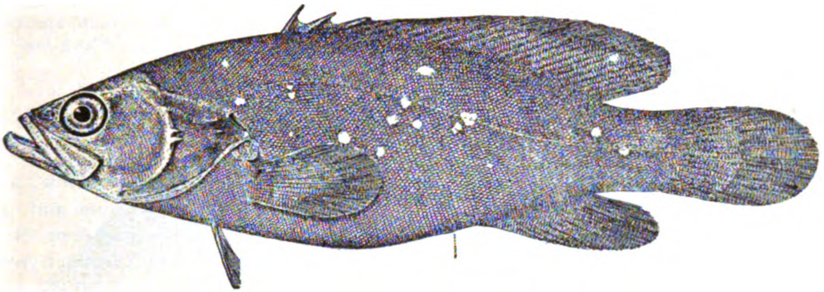

FIG. 46.—*Rypticus bistrispinus.*

118. **Rypticus coriaceus** (Cope). *Black Soap-fish.*

Head 3.3; depth 3.5; eye 5; snout 5.8; maxillary 2.4; mandible 1.7; interorbital 11.5; scales 19-125-32; D. III-25; A. 15; pectoral 1.5 in head; ventral 2.8; caudal 1.3.

Body rather elongate, compressed, back little elevated; head pointed, snout small, pointed; mouth large, somewhat oblique, maxillary reaching beyond orbit, its fore end very broad, triangular; lower jaw strongly projecting; teeth rather strong; interorbital narrow; preopercular spines 2, the lower the larger; opercle with 2 obscure spines, partly covered with skin, the lower the stronger; caudal peduncle compressed, deep, least depth 2 in head, its least width about 6 in its depth. Scales small, more or less embedded, especially on nape and cheeks. Fins all rather large; dorsal well separated, spines short; last dorsal rays about 2 in head; last anal rays about 2.75 in head; caudal rounded, its middle rays about 1.5 in head; pectoral broadly rounded; ventrals short, 2 times eye.

Color, plain brown, darkest on back; under parts paler; a broad white line from tip of lower lip to occiput; vertical fins dark, edges black; pectoral with some dark; ventrals pale.

Two specimens obtained, one 4.75 inches long, at Mayaguez, and one 5.5 inches long at Hucares. This West Indian species has hitherto been known only from St. Martins and Jamaica.

Eleutheractis coriaceus Cope, Trans. Amer. Philos. Soc, 1870, 467, St. Martins.
Rypticus coriaceus, Jordan & Evermann, l. c., 1235, 1896.

119. **Rypticus bistrispinus** (Mitchill).

Head 3; depth 3.6; eye 4.5; snout 4.75; maxillary 2.1; mandible 1.8; interorbital 7; D. II, 26; A. 15. Body rather slender, depth considerably less than length of head; head compressed, snout pointed; mouth large, lower jaw strongly projecting, maxillary reaching posterior border of orbit, its exposed portion broadly triangular; interorbital very narrow; 3 strong, distinct, preopercular spines, nearly uniform in size, middle one sometimes slightly the largest; opercle with 3 flat spines, middle one largest; opercle ending in a long flap; scales very minute, cycloid; entire head scaled; lateral line complete, arched above pectoral; dorsal fin continuous, spinous portion continuous with soft rays; second dorsal spine longer than first, about equal to diameter of orbit; last dorsal rays longest, about 2.5 in head; anal resembling last portion of dorsal, its longest ray 2.5 in head; pectoral broad and rounded, its length 1.9 in head; ventrals short, scarcely greater than orbit; caudal rounded.

Color in alcohol: Rich brownish or olivaceous above, paler below; upper half of head to level of lower part of eye dark-brown; lower half of head pale-yellowish, usually with scattered minute brown specks; tip of lower jaw brown; pale median line from tip of snout to nuchal region, growing less distinct posteriorly; whole body, and usually most of head, covered profusely with small rich brown spots, largest above pectoral; under jaw, throat, and breast often immaculate; fins usually unspotted.

South Atlantic coast of the United States and West Indies, usually in rather deep water; known from off Charleston, the Bahamas, Key West, Pensacola, Cuba, and Porto Rico, and occasionally taken off Newport, Rhode Island. Nineteen specimens obtained by the Porto Rico expedition from the vicinity of Culebra Island, some dredged in 12 to 15 fathoms, others found in shallow water about the coral reefs; length about 3 inches. These specimens agree fully with Mitchill's original description of this species and with the type of *R. pituitosus* Goode & Bean.

Bodianus bistrispinus Mitchill, Amer. Month. Mag. and Crit. Rev., II, Feb., 1818, 247, deep water in Bahama Straits.
Rhypticus maculatus Holbrook, Ichth. S. Carolina, ed. 1, 39, 1856, and ed. 2, 42, 1860, Cape Romain, South Carolina.
Rhypticus pituitosus Goode & Bean, Proc. U. S. N. M. 1879, 341, Key West, Florida.
Rypticus bistrispinus, Jordan & Evermann, l. c., 1233, 1896.

Family XLII. LOBOTIDÆ. The Triple-tails.

This family is thus defined by Dr. Gill:

"Percoidea with an oblong, compressed body, equally developed above and below; a short snout and anterior eyes; edentulous palate; dorsal and anal with the soft portions equal and opposite, the former preceded by a much larger spinous portion, the latter with 3 spines; vertebræ 24, 12 abdominal and 12 caudal, the fifth to eleventh with short but gradually lengthening parapophyses projecting sideways and behind downward, and the twelfth with the parapophyses elongated, converging at their extremities and fitting into a groove of the first hæmal spine, the costiferous pits excavated obliquely in the developed parapophyses, and gradually ascending forward on the vertebræ, and finally on the neurapophyses; the skull with its frontal portion broad, expanded forward and outward, and entering into the posterior borders of the orbits, which are advanced far forward; the postfrontals elongated forward and underlying the frontals; ethmoid short, decurved, and expanded sideways."

This family contains a single species, a large fish closely allied to the *Serranidæ*, but lacking vomerine and palatine teeth, and with the fore part of the head very short. Its relations are decidedly with the *Serranidæ* and not with the *Hæmulidæ*, with which group, however, it agrees in the absence of teeth on the palate.

Genus 75. LOBOTES Cuvier.

Body oblong, compressed, and elevated, covered with moderate-sized, weakly ctenoid scales; profile of head concave, snout prominent; mouth moderate, oblique, with thick lips; upper jaw very protractile, the lower longer; maxillary without supplemental bone; jaws with narrow bands of villiform teeth, in front of which is a row of larger conical teeth directed backward; no teeth on vomer or palatines; preorbital narrower than eye; preopercle strongly serrate. Branchiostegals 6. Dorsal fin continuous, with 12 spines, which may be depressed into a shallow groove; soft rays of dorsal and anal fins elevated; anal spines graduated; bases of soft dorsal and anal thickened and scaly; caudal rounded. Air-bladder present. Pyloric cæca 3.

120. **Lobotes surinamensis** (Bloch). *"Sama"; Flasher; Triple-tail; Dormeur.*

Head 2.8; depth 2; eye 6.5; snout 4.1; maxillary 2.8; mandible 1.9; interorbital 3.5; D. XI, I, 15; A. III, 11; pectoral 1.7; ventral 1.4; caudal 1.4; scales 5-48-15.

Resembling the serranoid genus *Alphestes* in form, but without teeth on vomer or palatines; scales large, firm, and ctenoid; anterior profile with a strong concavity at occiput; eye small; mouth small, lower jaw projecting; teeth in a narrow villiform band in each jaw, with a single outer row of enlarged conical teeth; preopercle with a few strong spines, those at angle greatly enlarged; soft dorsal and anal high, nearly as large as caudal, the 3 fins suggesting a 3-lobed tail, whence the name "triple-tail."

Color in life: Body greenish, grayish, and yellowish, more or less mottled; fins mottled-grayish; soft dorsal and anal black-edged, caudal with yellowish margin, black inside; ventral pale, with black blotches; branchiostegals pale, with irregular black lines; our smaller specimen creamy-yellow, overlaid with dark-brown.

A fish of rather sluggish habits, found in most warm seas; north on our coast to Cape Cod; probably not uncommon about Porto Rico; not recorded from Key West, though known from the St. Johns and Indian rivers, Pensacola and Tampa. It is said to reach a length of 3 feet and a weight of 50 pounds, and is regarded as a very good food-fish. The collection contains two young examples, 6.5 and 8 inches in length. The smaller was taken by the seine at the mouth of the Rio Bayamon at Palo Seco, in water very nearly fresh; the other was seined in San Juan Harbor between Palo Seco and Cataño.

Holocentrus surinamensis Bloch, Ichth., pl. 243, 1790, Surinam.
Bodianus triurus Mitchill, Trans. Lit. and Phil. Soc., I, 1815, 418, Powles Hook, New Jersey.
Lobotes erate Cuvier & Valenciennes, Hist. Nat. Poiss., V, 322, 1830, Pondicherry.
Lobotes farkharii Cuvier & Valenciennes, Hist. Nat. Poiss., V, 324, 1830, Malacca; on a drawing by Major Farkhar.
Lobotes somnolentus Cuvier & Valenciennes, Hist. Nat. Poiss., V, 324, 1830, Santo Domingo.
Lobotes auctorum Günther, Cat., I, 338, 1859, Cuba; Calcutta; China.
Lobotes surinamensis, Poey, Fauna Puerto-Riq., 329, 1881; Stahl, l. c., 77 and 163, 1883; Jordan & Evermann, l. c., 1235, 1896.

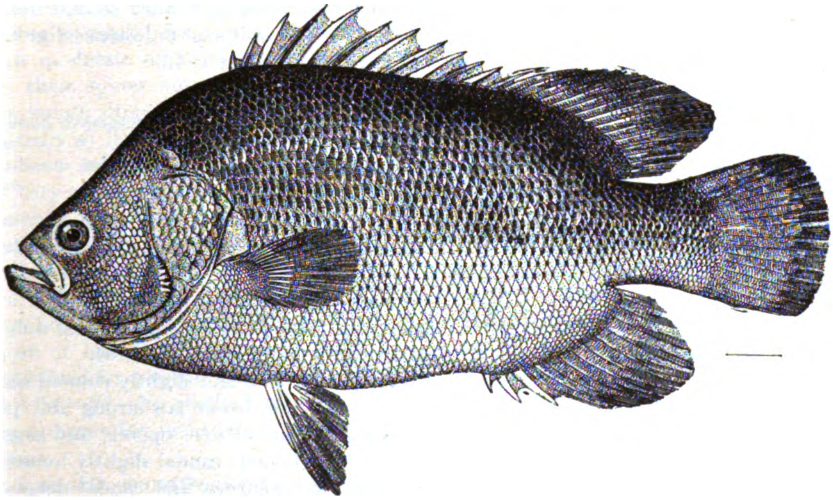

FIG. 47.—*Lobotes surinamensis.*

Family XLIII. PRIACANTHIDÆ. The Catalufas.

Body oblong or ovate, compressed, covered with small, firm, rough scales; all parts of body and head, even the snout and maxillaries, being densely scaly, each scale with a more or less developed plate on its posterior border, most developed in the young. Head deep. Mouth large, very oblique, lower jaw prominent. Villiform teeth on jaws, vomer, and palatines, none on tongue. Premaxillaries protractile. Maxillary broad, without supplemental bone, not slipping under the very narrow preorbital, which is usually serrate; no suborbital stay Eye very large, forming about one-half length of side of head. Posterior nostril long, slit-like, close to eye. Preopercle more or less serrated, one or more strong spines at its angle; operculum very short, ending in two or three points behind; no barbels. Gill-membranes separate, free from isthmus. Pseudobranchiæ very large, extending along whole length of opercle. Postorbital part of head very short, opercle small. Gills 4, a slit behind the fourth. Gillrakers long. Branchiostegals 6. Lateral line continuous, not extending on caudal. Dorsal fin continuous, x, 9 to 15, spines depressible in a groove; anal rays III, 9 to 15, soft part long, similar to soft dorsal, spines strong; ventrals very large, thoracic, I, 5, close together, in advance of base of pectoral, joined to belly by a membrane which incloses a groove; no axillary process; spine strong; pectoral small, pointed, not symmetrical, of 19 or 20 rays, upper longest; caudal fin truncate or lunate. Spines of fins generally rough, with small serræ. Air-bladder large. Pyloric cæca few. Vertebræ in reduced number, 9 or 10 + 13 = 22 or 23, first vertebræ being very small or absent; transverse process beginning on seventh (sixth) vertebra, last two precaudal bridged across; ribs attached to transverse processes; epipleurals absent on last three precaudal vertebræ. Supraoccipital crest very low, continued forward to over front of orbit, where it is joined by parietal crests; processes of premaxillaries moderate.

Carnivorous fishes of the tropical seas, chiefly in deep waters; mostly rose-colored in life.

a. Scales very small, 80 to 100 in lateral line; body oblong, its depth not half its length; preopercle with a flat spine; dorsal and anal each with 12 to 15 soft rays .... PRIACANTHUS, 76

aa. Scales large and very rough, 35 to 50 in lateral line; body ovate, its depth more than half its length; preopercle without spines; dorsal and anal each with 9 to 11 soft rays .... PSEUDOPRIACANTHUS

Genus 76. PRIACANTHUS Cuvier.

Scales very small, 80 to 100 in lateral line; body oblong, more than twice as long as deep; preopercle with a spine at angle; interorbital area externally transversely convex, cranium itself transversely concave, elevation being formed of flesh; a conspicuous foramen in interorbital area; lateral line extending upward and backward from upper angle of gill-opening toward second dorsal spine, below which it changes its course, following outline of back to end of dorsal fin, thence direct to middle of caudal; anal fin rather long, its rays about III, 14; dorsal rays about x, 13.

Species rather numerous, in the tropical seas.

a. Preopercular spine obsolete or nearly so; depth about equal to length of head; dorsal unspotted; dorsal rays x, 14; anal III, 15 .... *arenatus*, 121

aa. Preopercular spine well developed; depth of body greater than length of head; dorsal spotted; dorsal rays x, 12 or x, 13, anal III, 13 or 14 .... *cruentatus*, 122

121. **Priacanthus arenatus** (Cuvier & Valenciennes). "*Toro*"; "*Comico*"; *Catalufa.*

(PLATE 16.)

Head 3.25; depth 2.8; eye 2.7; snout 3; maxillary 2; mandible 1.6; interorbital 4.6; D. x, 14, rarely 13; A. III, 15, rarely 16; pectoral 1.9; ventral 1.1; caudal 1.2; scales about 94.

Body oblong-ovate, compressed, covered with small, very firm, and slightly ctenoid scales; head almost entirely scaled; eye very large; mouth extremely oblique; lower jaw strong and prominent; maxillary very broad posteriorly, reaching slightly beyond front of eye; opercle and angle of preopercle each with a weak flat spine; dorsal spines slightly roughened; caudal slightly lunate.

Color in life: Body and fins nearly everywhere bright-red, ventrals and caudal deepest; base of pectoral yellow; ventral spine pale-blue, rays black-tipped, most of membrane dusky; soft dorsal and anal with a few small dusky spots, and faintly edged with dark; caudal distinctly dark-edged; upper edge of caudal peduncle dusky; a series of about 12 indistinct dark round blotches along and just above lateral line; inside of mouth red behind; iris chiefly bright-red, a narrow yellow circle about pupil.

This fish occurs in the tropical Atlantic south to Brazil, occasionally northward in the Gulf Stream to Newport and Woods Hole; also known from Jamaica, Key West, and Madeira; probably common about Porto Rico. Our collection contains six examples, 6 to 12 inches long, from Aguadilla, Mayaguez, and Arroyo. It does not usually exceed a foot or 15 inches in length, but is a food-fish of some importance. Its flesh is firm and flaky and of good flavor. Nothing is known as to its game qualities. The brilliant red color and large eye make this a very striking fish.

Catalufa, Parra, Dif. Piezas Hist. Nat., pl. 20, 1787, Havana.

Priacanthus arenatus Cuvier & Valenciennes, Hist. Nat. Poiss., III, 97, 1829, Brazil and Atlantic; Jordan & Evermann, l. c., 1237, 1896.

Priacanthus fulgens Lowe, Trans. Zool. Soc. Lond., II, 1839, 174, Madeira.

Priacanthus catalufa Poey, Proc. Ac. Nat. Sci. Phila. 1863, 182, Havana.

122. Priacanthus cruentatus (Lacépède). *"Ojon"; Catalufa; "Ojudo"; Big-eye.*

Head 3; depth 2.5; eye 2.6; snout 3.2; maxillary 2; mandible 1.6; interorbital 3.7; D. x, 13; A. III, 14; pectoral 1.8; ventral 1.4; caudal 1.2; scales about 90. Body deeper than in *P. arenatus*, and preopercular spine stronger, curved, and serrate.

Color in life: Body silvery, washed with rosy; back with five or six rosy, saddle-like blotches extending on sides to below lateral line; under parts rosy; vertical fins with pale bases, brighter outwardly; caudal black-edged; pectoral and ventral rosy, ventral black-tipped.

This fish ranges from the West Indies to St. Helena and the Canaries, and is known from Cuba, Jamaica, and Porto Rico, but not yet recorded from the United States. Probably not common in Porto Rico. Our collection contains but a single specimen, 8 inches long, obtained in the San Juan market, though others were seen. It reaches a length of a foot or more, and is a good food-fish, common in the Havana market.

Labrus cruentatus Lacépède, Hist. Nat. Poiss., III. 522, 1800, Martinique.

Priacanthus cepedianus Desmarest, Prem. Déc. Ichthy., 9, pl. 1, 1823, Havana; Poey, Fauna Puerto-Riqueña, 322, 1881 Stahl, l. c., 76 and 162, 1883.

Priacanthus cruentatus, Stahl, l. c., 76 and 162, 1883; Jordan & Evermann, l. c., 1238, 1896.

Family XLIV LUTIANIDÆ. The Snappers.

Body oblong or more or less elevated, covered with moderate-sized adherent scales, which are more or less strongly ctenoid or almost cycloid. Lateral line well developed, concurrent with back, not extending on caudal fin. Head large, crests on skull usually largely developed. No suborbital stay; mouth moderate or large, usually terminal, low, and horizontal. Premaxillaries moderately protractile, their spines not extending to occiput; maxillary long, without supplemental bone, for most of its length slipping under edge of preorbital, which forms a more or less distinct sheath, its form essentially as in the *Serranidæ;* teeth various, unequal, and sharp, never incisor-like, some of them sometimes molar; vomer and palatines usually with villiform teeth, these sometimes molar, sometimes very small, sometimes wanting; lower pharyngeals separate; gills 4, a slit behind fourth; pseudobranchiæ large; gillrakers moderate or long, slender; gill-membranes separate, free from isthmus. Preopercle serrate or entire; opercles without spines; sides of head usually scaly. Dorsal fin single, continuous, or deeply notched, sometimes divided into two fins, spines usually strong, depressible in a groove, heteracanthous, that is, alternating, one stronger on right side, other on left; spines 10 to 12 in number. Anal fin similar to soft dorsal and with 3 spines; ventral fins thoracic, the rays I, 5, with a more or less distinct scale-like appendage at base; caudal fin usually more or less concave behind. Air-bladder present, usually simple. Intestinal canal short. Pyloric cæca few. Vertebræ usually 10 + 14 = 24. No distinct tubercles from cranium for articulation of epipharyngeal bones; enlarged apophyses for articulation of palatine and preorbital bones; anterior 4 vertebræ without parapophyses.

The *Lutianidæ* comprise about 20 genera and some 250 species, chiefly inhabiting shores of warm regions, all active, carnivorous, and voracious, and all valued as food. The group is closely related to the *Serranidæ* on the one hand and to the *Hæmulidæ* on the other.

HOPLOPAGRINÆ:
  a. Vomer with teeth.
  b. Nostrils near together, placed just before eye, anterior not tubular; vomerine teeth villiform, the patch ∧, ⩚, or ◇-shaped; teeth in jaws all acute; no incisors or molars.
  c. Palatines with teeth; teeth in jaws strong, more or less unequal.
LUTIANINÆ:
  d. Interorbital area not flat nor separated from occipital region, median and lateral crests procurrent on it, and frontal narrowed forward; dorsal fin continuous, spines not separated by a notch from soft rays.
  e. Prefontals with articular facets arising from diverging V-shaped ridges; basi-sphenoid with an anterior lobiform extension; soft dorsal and anal scaly; dorsal spines 10 or 11 (in American species); tongue with teeth (at least in adult examples).
  f. Fronto-occipital crest ceasing anteriorly far from front of frontal; prefrontal with posterior areas impressed, long, and cribriform; no pterygoid teeth; caudal fin lunate or forked; gillrakers rather few, shortish.
  g. Top of head naked; an oblique band of scales on each side of nape; parietal crest not confluent with fronto-occipital crest, either fading away anteriorly or running into ocular rim; preopercle with a shallow notch or emargination only .... NEOMÆNIS, 77

ff. Fronto-occipital crest continued forward along top of head to nearly opposite nostrils; prefrontals with posterior area short, excavated above and in front.

h. Gillrakers long and numerous, about 25; anal rather high, its rays III, 9; pterygoid teeth present (in the adult) in a narrow band; caudal fin very deeply forked.......... OCYURUS, 78

ee. Prefrontals with articular facets developed from simple tubercles and not V-shaped; basi-sphenoid not lobigerous; canines small; soft rays of dorsal 10 or 11.

i. Prefrontals with posterior areas cribriform; pterygoids with a broad patch of teeth (in adult); hyoid bones and tongue with teeth; canines very small or obsolete; dorsal spines 12 (or 13); soft dorsal and anal somewhat scaled; top of head scaled to before middle of eye; gillrakers numerous.......... RHOMBOPLITES, 79

ii. Prefrontals with posterior areas solid and somewhat tumid; pterygoids, hyoid bone, and tongue toothless; dorsal spines 10; soft dorsal and anal scaleless.......... APSILUS

ETELINÆ:

dd. Interorbital area flat, separated by a transverse line of demarcation from occipital, by which median as well as lateral crests are limited; frontals wide in front; tongue and pterygoids toothless; soft rays of dorsal 10 or 11.

j. Dorsal fin continuous; frontals not cavernous; supraorbital margin crenate; pterotic region much swollen outward and with bones thin and polished; preorbital moderate; frontals behind with funnel-shaped foramina; soft dorsal and anal scaleless; last rays of dorsal and anal produced.......... APRION

jj. Dorsal nearly or quite divided into two fins by a deep notch; eye very large; preorbital very narrow.

k. Frontals not cavernous, simply normally perforate; supraorbital margins crenate; prefrontals behind, with funnel-shaped foramina; head naked above and on snout; soft dorsal and anal naked; peritoneum and lining of gill-cavity pale; caudal deeply forked; color crimson.......... ETELIS, 80

kk. Frontals cavernous (like those of Sciænoids), with longitudinal, osseous bars, leaving interspaces in front of transverse ridge and on each side near front; supraorbital margins smooth; prefrontals behind with simple foramina for olfactory nerves; head scaly above and on jaws and snout; soft dorsal and anal scaly at base; peritoneum and lining of gill-cavity black; caudal lunate. Deep-water species, blackish-purple in color... VERILUS

DENTICINÆ:

aa. Vomer and palatines toothless; one or both jaws with strong canines; no molars; preopercle entire; dorsal continuous.

l. Dorsal spines 10; scales large, 50 in lateral line, those on cheek in 3 rows; mouth moderate, jaws subequal; fins usually with filaments.......... NEMIPTERUS

Genus 77. NEOMÆNIS Girard. Snappers.

Body oblong, compressed, back somewhat elevated; head long, naked above, except for a broad oblique band of scales at nape; nostrils normally close together, neither with a tube; mouth large, jaws with bands of villiform teeth, besides which is usually an outer series of larger teeth in each jaw, and 2 to 4 stronger teeth or canines in front of upper jaw; vomer with villiform teeth; villiform teeth on palatines; usually one or more patches of teeth on tongue in the adult; no molar teeth; no teeth on pterygoids; preopercle without notch or with a shallow emargination; posterior limb of preopercle finely serrate; gillrakers rather few, shortish; soft rays of dorsal and anal scaly at base; dorsal spines 10 (rarely 11), continuous with soft rays; caudal lunate or forked; anal rays 7 to 9. Interorbital area not flat nor separated from occipital region, median and lateral crests procurrent on it, and frontal narrowed forward; fronto-occipital crest ceasing anteriorly far from front of frontal, usually behind eye; prefrontal with posterior areas impressed, long and cribriform; parietal crest not confluent with orbital rim, but nearly or quite joined anteriorly to fronto-occipital crest (in species examined); prefrontals with articular facets arising from diverging V-shaped ridges; basisphenoid with an anterior lobiform extension. Vertebræ $10 + 14 = 24$.

We follow Jordan & Evermann in separating the American pargos or snappers from the Old World genus *Lutianus* on the following characters, distinctive so far as known: Parietal crest usually confluent anteriorly with orbital rim, never joined anteriorly to fronto-occipital crest; top of head naked; a more or less isolated band of scales extending obliquely on each side of nape; notch on preopercle for reception of knob of interopercle shallow and broad, sometimes obsolete, otherwise essentially as in *Lutianus*.

Species very numerous, American; active predatory fishes, highly valued as food.

Among the food-fishes of Key West and the West Indies no fewer than 15 species belong to this genus, while on our Pacific coast are at least 5 more species, and all of them are excellent for food. Most of the species reach a good size and are objects of important fisheries.

a. Soft dorsal normally with 14 rays, rarely with 13.

b. Anal fin rounded, its middle rays less than half length of head; no black lateral spot.

c. Developed gillrakers 7 to 9, usually with few rudiments, if any; preorbital deep; caudal lunate. Shallow-water species, olivaceous in color, more or less marked by crossbands when young, often with a blue streak along preorbital.

d. Vomerine teeth forming a ∧ or ⩚ shaped patch, backward prolongation on median line very short or wanting; scales above lateral line in oblique series, which are not throughout parallel with it; body comparatively elongate, depth 3 to 3.5 in length. upper and lower canines very strong, lower considerably stronger than in other species; mouth very large; vertical fins dusky; size very large.

e. Maxillary 2.29 in head; preorbital 4.75 in head; maxillary reaching past middle of eye, about 2.33 in head; usually a black spot or shade at base of pectoral; head 2.75; depth 3; D. x, 14; A. III, 8; scales 7–50–12..... *cyanopterus*, 123

dd. Vomerine teeth forming an anchor-shaped patch, with a distinct backward prolongation on median line; second anal spine little, if any, shorter than third; upper canines strong, lower moderate or small.

f. Scales above lateral line arranged in series which are not throughout parallel with lateral line, being oblique and irregular, at least below second dorsal.

g. Body comparatively elongate, depth 2.75 to 3 in length; mouth large, maxillary 2.5 in head; scales 7 in an oblique series between dorsal and lateral line; pectoral short, not two-thirds length of head; soft dorsal, anal, and caudal blackish, tinged with wine-color, always becoming dusky in spirits.......................... *griseus*, 124

gg. Body comparatively deep, depth about 2.5 in length; snout long and pointed; mouth rather small, maxillary about 3 in head; pectoral long, more than two-thirds length of head; soft dorsal, anal, and caudal orange or yellow, becoming pale in spirits.

h. Scales moderate, about 9 in an oblique series from first dorsal to lateral line, about 55 vertical series above lateral line between gill-opening and base of caudal; lateral line with more than 45 pores; a whitish area below eye; blue streak along suborbital region usually not disappearing with age; scales 8–56–15.................. *jocu*, 125

hh. Scales unusually large, 5 or 6 in an oblique series from first dorsal to lateral line, about 45 vertical series above lateral line between gill-opening and base of caudal; lateral line with fewer than 40 pores; blue streak on suborbital region not permanent; scales 6–44–13.. *apodus*, 126

cc. Developed gillrakers more numerous, about 10, with several rudiments before them (in *N. buccanella;* not examined in *N. lutjanoides*).

i. Caudal deeply forked; mouth small, maxillary reaching posterior nostril; preopercle slightly notched, little serrate; canines strong; tongue with teeth; soft dorsal and anal rounded; pectoral pointed, 4.5 in total length. Color brownish-green, with 6 brown crossbands; a broad greenish stripe from opercle to base of caudal. D. x, 14; A. III, 8.. *lutjanoides*

ii. Caudal moderately forked; mouth large, maxillary reaching anterior edge of eye, 2.6 in head; preopercle serrate, serræ strong on angle; canines medium; vomerine teeth in an anchor-shaped patch; eye large; the base and axil of pectoral with a jet-black blotch; scales moderate, about 8 oblique series from the lateral line to first dorsal spine, about 63 vertical rows above lateral line; second anal spine long, about 2.66 in head. Color crimson; caudal peduncle and caudal fin largely yellow; iris orange-red; no lateral blotch. Head 2.5; depth 2.8; D. x, 14; A. III, 8; scales 8–63–15.. *buccanella*

bb. Anal fin angulated, its median rays produced, longest in adult, at least half head; body rather robust; upper canines rather long; lower small. Color more or less red, young with a black lateral blotch.

j. Scales above lateral line arranged in series, which are not throughout parallel with it; side with a black blotch, which usually disappears with age; anal fin bright red.

k. Teeth on vomer in an anchor-shaped patch, with a median backward prolongation; lingual teeth well developed; maxillary reaching edge of pupil, 2.5 in head; caudal edged with black.

l. Iris golden-yellow in life. Scales rather small, 9–72–10, about 50 pores in lateral line; body rather slender, depth 2.5 in length; second anal spine about 3.5 in head; gillrakers 9 below angle; eye large, 4.75 in head in adult; preorbital 5.75 in head. Color bright rose-red, with golden streaks................................. *vivanus*, 127

ll. Iris rose-red. Scales rather large, 8–60–14; body robust, depth 2.6 in length; second anal spine about 4 in head; gillrakers about 8 below angle. Color rose-red, nearly uniform; size large.............................. *aya*, 128

kk. Teeth in vomer in a Λ-shaped patch, without distinct prolongation on median line; lingual teeth very few or none; maxillary reaching edge of eye, 2.7 in head.. *analis*, 129

aa. Soft dorsal with 12 rays (rarely 13); body oblong, the back not greatly elevated; upper canines moderate, lower small or obsolete; scales above lateral line in very oblique series; anal fin low, its outline rounded.

m. Mouth moderate; maxillary 2.6 to 2.75 in head.

n. Caudal not deeply forked; gillrakers rather few (8 or 9 besides rudiments).

o. Pectoral short, 1.66 in head; teeth on vomer in an anchor-shaped patch. Color olivaceous, no black lateral blotch; lower jaw included. Head 2.75; depth 3; D. x, 12; A. III, 8; scales 8–51–x. (Hybrid, *griseus* + *synagris?*). *brachypterus*

oo. Pectoral long, more than two-thirds length of head; color chiefly red; a large black lateral blotch; lower jaw slightly projecting.

p. Vomer with teeth in a Λ or ⩚ shaped patch, the prolongation on median line short.

q. Eye large, 4.75 in head; back greatly elevated; pectoral long, 1.25 in head...................... *megalophthalmus*, 130

qq. Eye smaller, 5 in head; back less elevated; pectoral shorter, 1.5 in head.............................. *synagris*, 131

nn. Caudal deeply forked; gillrakers rather numerous, about 10 on lower part of anterior arch; teeth on vomer in an anchor-shaped patch; body rather elongate, compressed; lower jaw projecting or not; eye small; scales small; lateral line with about 50 pores; anal spines graduated. Color reddish, with horizontal yellow streaks; no black lateral blotch. Head 3; depth 3; D. x, 13; A. III, 9; scales 9–53–15....................................... *ambiguus*

mm. Mouth large; maxillary 2.4 in head; teeth on vomer in an anchor-shaped patch.................. *mahogoni*, 132

123. **Neomænis cyanopterus** (Cuvier & Valenciennes). *Cubera.*

Head 2.75; depth 3; eye rather small, 5.66 in head; D. x, 14; A. III, 8; scales (6) 7–50–12, 50 pores. Body elongate, rather robust, back little elevated; profile from snout to nape nearly straight; snout long, thick, rather acute in profile, 3 in head; interorbital space flattish or gently convex, 6.25 in head; occipital keel low; preorbital broad, 4.66 in head; mouth very large; maxillary reaching middle of eye, 2.33 in head. Canine teeth larger than in any other of the genus, especially those in lower jaw; upper jaw with a narrow band of villiform teeth, outside of which is a series of strong, sharp teeth; 4 canines in front, 2 of them very long and strong, their length two-thirds diameter of eye; lower jaw with 5 or 6 very strong canine-like teeth on each side, largest little smaller than canines of upper jaw; a few villiform teeth in front of jaw; tongue with a large oblanceolate patch of teeth, pointed behind, its length about twice its greatest width; vomer with a Λ-shaped patch of teeth, usually without backward prolongation on median line, but sometimes with a short median prolongation (⩚-shaped), its length always less than width of patch in front; pterygoid and hyoid bones without teeth. Gillrakers rather short and thick, about one-third length of diameter of eye, about 8 on lower arch; no rudiments. Preopercle with posterior margin nearly vertical, emargination broad and shallow, the edge finely serrate above, teeth coarser just above angle, lower limb almost entire. Scales rather large, loosely attached; cheek with about 8 rows, 1 row on interopercle, 1 row on subopercle, and about 7 on opercle; temporal region with about 2 rows of large scales; tubes of lateral line simple; base of soft dorsal and anal scaly. Dorsal spines rather strong, outline of fin gently convex, fourth spine longest, 3.25 in head; tenth spine, 6 in head; anal spines strong, second spine stronger, slightly shorter than third, which is 5 in head; caudal little forked; pectoral about 1.4 in head.

Color, dusky-gray, paler below, belly sometimes tinged with reddish; membranes of dorsal, anal, and caudal grayish-black, anal and soft dorsal especially blackish; ventrals blackish at tip; pectoral plain olivaceous, base and inner margin dusky; head dusky above, without markings.

This fish attains a length of 2 to 4 feet; the specimen described (from Cuba) measured 17½ inches. It is found in the West Indies and south to Brazil, and is rather common. It is a large, coarse fish, regarded as unwholesome by fishermen, but probably without sufficient cause. It is recorded by Cuvier & Valenciennes and by Poey from Porto Rico; not seen there by us.

Mesoprion cyanopterus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 472, 1828, Brazil.
? *Mesoprion pargus* Cuvier & Valenciennes, Hist. Nat. Poiss., II, 473, 1828, Porto Rico.
Lutjanus dentatus A. Duméril, in Vaillant & Bocourt, Miss. Sci. au Mex., 125, 1881, Brazil.
Lutjanus pargus, Poey, Fauna Puerto-Riqueña, 320, 1881.
Neomænis cyanopterus, Jordan & Evermann, l. c., 1254, 1898.

124. **Neomænis griseus** (Linnæus). *Gray Snapper; Mangrove Snapper; Cabellerote; "Pargo Prieto."*

(PLATE 17.)

Head 2.75; depth 2.87 to 3.25; D. x, 14; A. III, 8; scales (6) 7–50–12, 47 pores. Body comparatively elongate, back not strongly compressed, little elevated; profile almost straight from snout to nape, thence gently convex. Snout rather pointed, 3 in head. Eye rather small, 4.66 in head. Interorbital space gently convex, 6 in head; occipital keel little prominent; preorbital rather broad, 5.5 to 6.5 in head. Mouth large; jaws subequal; maxillary reaching front of pupil, 2.6 in head; upper jaw with a narrow band of villiform teeth, outside of which is a single series of enlarged teeth; 4 canines in front of upper jaw, 2 of them quite large—one-third diameter of eye; lower jaw with a very narrow band of villiform teeth in front of jaw only; outside of these a single row of teeth larger than outer teeth of upper jaw, becoming canine-like in adult; tongue with an oval patch of teeth, its width about half its length; vomer with an arrow-shaped patch of teeth, with backward prolongation on median line, its length about twice its width in front. Gillrakers rather short and thick, their length about one-third diameter of eye, about 8 on lower arch, with no rudimentary ones before them. Preopercle with its posterior margin nearly vertical, with rather broad and deep emargination; preopercle finely serrate above, teeth coarser at angle. Scales comparatively large, rows in horizontal series below lateral line, those above running parallel with lateral line until below soft dorsal, where they become slightly irregular and oblique; 7 rows of scales on cheek; an embedded row on interopercle; 1 row on subopercle, and 7 on opercle; temporal region with about 3 rows of large scales; top of head, snout, and jaws naked; base of soft dorsal and anal scaly; tubes of lateral line branched. Dorsal spines rather strong, the outline of fin gently convex; fourth spine longest, 2.5 in head, tenth spine 4 in head; margin of soft dorsal rounded; ninth and tenth rays longest, 1.33 length of first, and 1.6 last ray, 2.5 in head; caudal emarginate, upper lobe longest, 1.33 length of middle rays, which are 1.75 in head; anal fin high, its margin slightly angulate, middle rays longest, 2 times length of last ray, 2.16 in head, first ray reaching almost to tip of last ray, when the fin is depressed; second anal spine as long or slightly longer and stronger than third, 3.25 to 4 in head; ventrals 1.75 in head; pectoral shortish, scarcely reaching vent, 1.57 in head.

Color in life: Very dark green above, middle part of each scale brassy-black, its edge broadly pearly-whitish; below lateral line the duskiness of middle of scale passes into brassy, and below into bright coppery, belly and lower parts of head being more or less distinctly bright coppery-red; lower jaw grayish; no blue stripe below eye, except in very young; top of head blackish-olive; dorsal blackish, its margin darker and tinged with maroon-red; soft dorsal dusky, anteriorly slightly edged with whitish; caudal violaceous or maroon-black; anal wine-color, edged with whitish; pectoral pale flesh-color; ventrals whitish, faintly marked with reddish. Young with a blackish band from snout through eye to nape, very distinct in life; a blue streak below eye; spinous dorsal with a dark maroon-colored band along edge. An example, 10.5 inches long, from the San Juan market, was brownish-red on body; blue suborbital streak quite distinct and continuous; two blue streaks below and forward from eye, only one on right side; apparently a deep-water example. Fishes from deep water are much redder than those taken near shore. In no case is the caudal yellowish or of any pale shade.

The above description chiefly from a specimen 11 inches long from Key West but verified on specimens from Porto Rico. The variations in proportional measurements are not great.

Found in the West Indies and ranging from New Jersey to Brazil; very common along our South Atlantic and Gulf coasts, occasionally straying northward as far as New Jersey, being the northernmost in its range of any member of the genus in the Atlantic; everywhere generally known as gray snapper. In Florida and the Bahamas, where the coasts are lined by mangrove bushes, among which the young of this species abound, the name mangrove snapper comes into use. It inhabits water of varying depths, large specimens being often found near the shore, while others may be taken in waters of considerable depth in company with *Neomænis aya*. These latter individuals are much redder than those found in shoal water; their general color is paler and the body is a trifle less elongate; such correspond to the form named *Lutjanus stearnsi*.

All the snappers are game-fishes of considerable importance, and the gray snapper is one of the best. Its abundance and wide distribution, the ease with which it can be found at all seasons, together with the readiness and vigor with which it takes the hook and the fairly good fight which it makes, should cause this fish to be much sought after by anglers who visit our southern and tropical waters.

In Indian River, Florida, the mangrove snapper is regarded as a very good food-fish and is of considerable commercial importance, its average weight being about 2 pounds, the maximum about 6 or 7 pounds. At Key West, where it is the most abundant of the snappers, it attains a length of 3 feet and a weight of 18 pounds, though the average of those caught is 5 pounds or less. Here it is usually called gray snapper and is regarded as a warm-water fish, being most plentiful in shallow water in summer, but retiring to deeper water during winter, and always running in schools; it is said to spawn in July and August, usually on the shoals, the eggs being nonadhesive and separating from each other at spawning; it is caught with hook and line, sardines and pilchard being the usual bait.

About Porto Rico this is an important food-fish and is known as "pargo prieto." Specimens are in the collection from San Juan market, Puerto Real, Arroyo, and Isabel Segunda, and one from San Geronimo. It was one of the most common species in the San Juan market and was seen in all the other markets of the island. The largest seen weighed about 6 pounds.

Turdus pinnis branchialibus carens (mangrove snapper), Catesby, Hist. Carolina, pl. 9, 1743, Bahamas.
Caballerote, Parra, Descr. Dif. Piezas, Hist. Nat., pl. 25, fig. 1, 1787. Havana.
Labrus griseus Linnæus, Syst. Nat., ed. X, 283, 1758, Bahamas; after Catesby.
Sparus tetracanthus Bloch, Ichthyol., pl. 279, 1791, Martinique; on a drawing by Plumier.
Anthias caballerote Bloch & Schneider, Syst. Ichth., 310, 1801, Cuba; after Parra.
Bodianus vivanet Lacépède, Hist. Nat. Poiss., IV, pl. 4, fig. 3, 1803, Martinique; on a drawing by Plumier.
Mesoprion griseus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 469, 1828, Santo Domingo; not after Linnæus.
Lobotes emarginatus Baird & Girard, 9th Smith. Rept. 1855, 332, Beesley Point, N. J.
Lutjanus stearnsi Goode & Bean, Proc. U. S. N. M. 1878, 179, Pensacola, Fla.
Neomænis griseus, Jordan & Evermann, l. c., 1255, 1898.

125. Neomænis jocu (Bloch & Schneider). "*Pargo Colorado*"; *Dog Snapper; Jocú.*

(PLATE 18.)

Head 2.57; depth 2.57; eye 4.75; snout 2.6; maxillary 2.57; mandible 5; interorbital 5.5; D. x, 13; A. III, 8; scales 8–50–16, about 45 pores. Body comparatively deep and compressed, back elevated; profile steep and almost straight from snout to nape, thence little convex; snout rather long and pointed; eye moderate; interorbital space narrow, gently convex; occipital keel moderate; preorbital broad, 4.33 in head; mouth rather large, jaws subequal; maxillary reaching front of orbit; upper jaw with a narrow band of villiform teeth, outside of which is a single series of larger teeth; 4 canines in front of upper jaw, 2 of them very large, almost equaling in length diameter of pupil; lower jaw with a narrow villiform band in front only, and a series of larger teeth outside, largest on side of jaw almost canine-like; tongue with a single large oval patch of teeth, its length more than twice its width; teeth on vomer forming a broadly arrow-shaped patch with backward prolongation on median line twice length of width of anterior part. Gillrakers rather short and thick, longest about one-fourth diameter of eye, about 9 on lower part of arch, with no rudiments in front of them. Preopercle with its posterior margin slanting obliquely downward and forward, emargination very broad and shallow; preopercle finely serrate above, teeth coarser at angle, which is not salient. Scales moderate, smaller than in *N. griseus* or *N. apodus*, in nearly horizontal series below, and obliquely upward and backward above lateral line; about 7 or 8 rows of scales on cheek; 1 row on interopercle, 1 on subopercle, and 7 on opercle; about 3 rows of large scales on temporal region; top of head, snout, and jaws naked; tubes of lateral line branched; bases of soft dorsal and anal scaly; dorsal spines rather strong, outline of fin evenly curved, fourth and fifth spines longest, 2.6 in head; tenth spine 4 in head; margin of soft dorsal convex, middle rays longest, 2.83 in head; caudal little forked, upper lobe longest, 1.4 length of middle rays, 1.6 in head; margin of anal well rounded, middle rays about twice length of last ray; first ray reaching nearly to tip of last ray when fin is depressed; pectoral slightly falcate, reaching almost to front of anal, 1.33 in head; anal spines strong, second rather longest and strongest, not always reaching past tip of third, 3.4 in head.

Color of adult in life: Olivaceous above, paler below, much flushed, so that the general hue is everywhere coppery-red; sides of body with numerous narrow crossbars, rather faint, the light and dark of about equal width, or the pale narrower; scales of upper parts mesially bronzed; head coppery; especially above; broad whitish area from eye to angle of mouth, becoming rosy in spirits; an irregular line of small round or oblong spots below the eye, from snout to angle of opercle; soft fins all plain light brick-red, anal somewhat orange, caudal more or less yellowish; spinous dorsal with a light orange band at base and edge, middle pearly; blue stripe below eye persisting longer than in any of the other species which possess it. Young, in life: Greenish-olive, head and breast flushed with bright coppery-red; base of each scale bright orange-yellow, this color more extensive than dark ground-color, so that the general hue of body, especially below and posteriorly, is rich golden-yellow; dusky spot on top of head; temporal region with a dusky shade; an undulating blue stripe below eye from snout to angle of opercle; a similar fainter streak below it; pectoral pale-red or light-orange; ventrals orange; other fins rich golden-yellow, front of anal and edge of spinous dorsal rich, clear, bright-orange.

The above description based upon specimens 10 and 12 inches long. The dog snapper bears some resemblance to the gray snapper, but is not quite so trim a fish, as may be seen by comparing plates 17 and 18. The body color is similar, but the fins are colored very differently.

This excellent food-fish is known from the West Indies south to Bahia and north to Florida Keys, occasionally straying north in the Gulf Stream to Woods Hole. It attains a weight of about 20 pounds, though the individuals usually seen are much smaller. At Key West it occurs in greatest numbers during fall and winter, but is not very common at any time; nor does it seem to be abundant in Porto Rico. A good many were seen in the market at San Juan where four, from 10 to 15 inches long, were obtained. Specimens were secured also at Palo Seco and Vieques Island. Our notes make no mention of it as having been seen elsewhere about the island.

Jocu, Parra, Descr. Dif. Piezas, Hist. Nat., I, pl. 25, fig. 2, 1787, Cuba.
Anthias jocu Bloch & Schneider, Syst. Ichth., 310, 1801, Cuba; after Parra.
Mesoprion litura Cuvier & Valenciennes Hist. Nat. Poiss., II, 467, 1828, Cayenne; St. Thomas.
Neomænis jocú, Jordan & Evermann, l. c., 1257, 1898.

126. **Neomænis apodus** (Walbaum). "*Pargo Amarilla*"; *Schoolmaster; Caji.*

(PLATE 19.)

Head 2.5; depth 2.83; eye 4.33; snout 2.67; maxillary 2.67; interorbital 4.83: preorbital 4.83; D. x, 14; A. III, 8; scales 5–42 to 45–13, about 36 pores. Body comparatively deep, moderately compressed, back considerably elevated; profile almost straight from snout to nape, nuchal region rather convex; snout unusually long and pointed, its outline before eye a little depressed, its length 2.71 in head; eye moderate, 4.33 in head; interorbital space flattish or gently convex. 5.5 in head;

mouth large, maxillary reaching front of orbit, 2.6 in head; upper jaw with a narrow band of villiform teeth, outside of which is a single series of larger teeth; 4 canines in front of upper jaw, one of them on each side very large, almost as long as pupil; lower jaw with a narrow villiform band in front only, and an enlarged series outside, these largest on side of jaw, where some of them are somewhat canine-like; tongue with a single large oval patch of teeth, its length more than twice its width; teeth on vomer forming an arrow-shaped patch with backward prolongation on median line, length of which is twice the width of arrow-patch in front. Gillrakers rather short and thick, longest about one-third diameter of eye, about 9 on lower part of arch. Preopercle with its posterior margin directed somewhat obliquely forward, usually very weakly emarginate, finely serrate above, almost entire at angle. Scales large, decidedly larger than in *N. jocu;* series below lateral line almost horizontal; those above in rows parallel with lateral line, these becoming more or less irregular posteriorly and extending upward and backward below soft dorsal; about 7 rows of scales on cheek, 1 row on interopercle, 1 on subopercle, and 7 on opercle; temporal region with a few large scales in about 2 rows; base of soft dorsal and anal scaly; tubes of lateral line each with 4 or 5 branches. Dorsal spines strong, outline of fin not greatly convex, fourth spine longest, 2.66 in head, tenth spine 4 in head; margin of soft dorsal well rounded, middle rays longest, twice length of last, 2.75 in head; caudal not deeply forked, upper lobe longer, 1.5 length of middle rays, which are 2 in head; margin of anal well rounded, its middle rays twice length of last, 2.3 in head, first ray reaching about to middle of last when fin is depressed; anal spines strong, second longer than third, 3.33 in head; ventrals 2 in head; pectoral reaching to front of anal, 1.33 in head.

Color of young in life: Greenish, with about eight very narrow vertical paler bars on body; scales of lower part of side with central orange spots, forming faint streaks along rows of scales; belly pearly; head greenish; a blackish streak from snout through eye to nape; a narrow, sharply defined blue stripe below eye from snout to angle of opercle; no lateral spot; spinous dorsal edged with orange; ventrals, anal, and caudal pale orange-yellow; pectoral paler. Adult examples differ from the young in the vertical bars being fainter or obsolete, and in the absence, usually, of blue stripe below eye and dark stripe on temporal region; soft dorsal, anal, and caudal always yellow, of varying intensity, and the edge of spinous dorsal orange, not dusky; the whitish area below eye, very constant in *N. jocu*, is wanting in *N. apodus.*

A specimen, 9 inches long, from Arroyo, had the following colors: Upper parts reddish or purplish and brownish, with some yellow or brassy tints; lower sides and belly purplish-rosy; cheek pale-rosy; top of head dark-rosy; lower jaw white; fins all rich orange or gamboge-yellow, a triangle at tip of each dorsal membrane very rich; ventral rays whiter than membranes; side with about 12 faint brassy lines running backward and somewhat upward; inside of mouth pale.

The schoolmaster is one of the most richly colored of the snappers, and is, withal, a very interesting and attractive fish. It is known from the West Indies, south to Bahia and north to southern Florida, sometimes straying northward in the Gulf Stream to Woods Hole; known from Indian River and Key West, but not common at either place. It is one of the most abundant of the snappers occurring in Porto Rico. Numerous specimens are in the collection from San Juan, Palo Seco, Puerto Real, Ensenada del Boqueron, Ponce, Arroyo, Hucares, Vieques, and Culebra. It is evidently one of the most valued food-fishes of the island. None seen about Porto Rico would exceed a pound in weight. At Key West it is said to reach a weight of 7 or 8 pounds, though the average of those caught on the reefs does not exceed 3 pounds, while those caught in the "bay" do not often weigh more than one-third of a pound. It is said to take the hook readily and with considerable vigor.

? Perca marina pinnis branchialibus carens (Schoolmaster), Catesby, Hist. Carolina, etc., tab. 41, 1743, Bahamas; figure very poor, the pectoral fins omitted.

Caxis, Parra, Descr. Dif. Piezas, Hist. Nat., pl. 8, fig. 2, 1787, Havana.

? Perca apoda ("Forster, Catal. of Anim., MS., 21," 1774; printed 1844), Walbaum, Artedi Piscium, 351, 1792, Bahamas; based on the schoolmaster of Catesby.

Sparus caxis Bloch & Schneider, Ichthyol., 284, 1801, Havana; after Parra.

Bodianus striatus Bloch & Schneider, Syst. Ichth., 335, pl. 65, 1801, West Indies; misprinted *albostriatus*, p. 237; called *B. fasciatus* on plate.

Lutjanus acutirostris Desmarest, Prem. Déc. Ichthyol., 12, pl. 3, 1823, Cuba.

Mesoprion cynodon Cuvier & Valenciennes, Hist. Nat. Poiss., II, 465, 1828, Martinique; Santo Domingo.

Mesoprion linea Cuvier & Valenciennes, Hist. Nat. Poiss., II, 468, 1828, Cuba; Santo Domingo.

Mesoprion flavescens Cuvier & Valenciennes, Hist. Nat. Poiss., II, 472, 1828, Martinique.

Neomænis apodus, Jordan & Evermann, l. c., 1258, 1898.

127. Neomænis aya (Bloch). *Red Snapper; Pargo Colorado; Pargo Guachinango; Acara Aya.*

(PLATE 20.)

Head 2.6; depth 2.6; D. x, 14; A. III, 9; scales (7) 8–60–15, pores 46. Body rather deep, moderately compressed, back well elevated, profile steep, and almost straight from snout to nape. Snout rather pointed, 2.8 in head; eye moderate, 5.5 in head (larger in young). Interorbital space angulate or strongly convex, 5 in head; occipital keel strong; preorbital rather broad, 5 in head; mouth rather large, maxillary reaching front of orbit, 2.5 in head; upper jaw with a narrow band of villiform teeth, outside of which is a row of larger but comparatively small teeth; 4 canines in front, 2 (sometimes duplicate) of them larger, their length about one-third diameter of eye; lower jaw with a single row of rather small teeth, usually largest on side of jaw, where some of them are almost canine-like; within these is a very narrow band of villiform teeth in front of jaw only; tongue with a broad oval patch of teeth, scarcely twice as broad as long; in front of this patch is a small, irregular patch; vomer with a broadly arrow-shaped patch, with a rather short backward prolongation on median line, its length about equaling width of patch in front. Gillrakers moderate, their length about half diameter of eye, 8 on lower arch. Preopercle with its posterior margin about vertical, its emargination deep, its edge rather finely serrate above, coarser at angle, dentate on lower border. Scales rather large, rows horizontal below lateral line, rows above running backward and upward; 6 rows of scales on cheek, 1 on interopercle, 1 on subopercle, and 7 on opercle; bases of soft dorsal and anal scaly; pores of lateral line branched; temporal region with a broad band of scales, with a few scattering ones below it; top of head, snout, and jaws naked. Dorsal spines rather strong, outline of fin moderately convex, fourth and fifth spines longest, 2.8 in head; tenth spine about 4 in head; margin of soft dorsal nearly straight, fin pointed behind; middle rays little longer than first ray, 1.5 length of last, 3 in head; caudal lunate, upper lobe scarcely longer than lower, its length 1.4 times length of middle rays, which are 1.86 in head; margin of anal strongly angulate, middle rays reaching nearly to base of caudal, 2.5 length of last ray, 1.8 in head; first ray reaches about to middle of last ray when fin is depressed; anal spines strong, second scarcely as long as third, 4 in head; ventrals, 1.8 in head; pectoral reaching to front of anal fin, 1.2 in head.

Color in life: Deep rose-red, paler on throat; bluish streaks along rows of scales, above becoming fainter and disappearing with age; fins brick-red; dorsal bordered with orange, with narrow blackish edge; caudal narrowly edged with blackish; eye red; a large blackish blotch above lateral line and below front rays of soft dorsal in the young, this spot usually disappearing with age; axil of pectoral dusky.

A specimen 21 inches long taken at Aguadilla, and from which plate 20 was made, showed in life the colors faithfully portrayed by the artist. The following color notes were made upon this specimen at the time: Back and side down to lateral line rich rosy, scales edged with paler; side below lateral line and belly pale-rosy; a small black spot just above lateral line below second and third dorsal rays; dorsal fins pale-rosy on basal half, tips of rays and spines pale-yellowish; caudal red, lower lobe richest, upper yellowish on outer portion; anal rich-rosy on anterior outer part, rest of fin paler; ventral rosy; pectoral pale-rosy; upper part of head rose-color, side paler; some irregular blue lines or spots about eye; inside of mouth white. The general color of the Porto Rican red snappers seems to be a decidedly paler red than that of Florida examples and the black spot on the side appears to be more persistent. Otherwise the colors are essentially the same.

Found from Long Island to Brazil on rocky banks in rather deep water, especially abundant in the Gulf of Mexico, off Cape San Blas and about Yucatan, where the most important fisheries are located; also abundant on the banks off eastern Florida and Georgia. About Porto Rico it is said to be plentiful, though at the time of our visit it was seen only at Aguadilla, probably because the fishermen of that place go out toward Mona Island and fish in deep water. It reaches a length of 2 to 3 feet and a weight of 30 to 40 pounds, though the average weight of those caught on the Florida "Snapper Banks" is much less. Adams and Kendall give the weight of those examined on the banks from the Tortugas to the latitude of Charlotte Harbor at 5 to 20 pounds. The largest seen by them was 32 inches long; one 30 inches long weighed 18 pounds.

The red snapper is the most valuable food-fish of the genus in the waters of the United States. It is the object of the principal fishery of Pensacola, from which point it is shipped fresh to all important cities in the United States as far north as Boston, Chicago, and Minneapolis and west to Omaha and Denver. In Florida it is known everywhere as "red snapper," or to the Spanish-speaking people as "pargo colorado." In Havana it is known as "pargo guachinango," or "Mexican snapper," because it was brought to that city from the coast of Mexico. In Porto Rico it is called "pargo colorado."

The red snapper is strictly carnivorous, feeding upon small fish, crabs, prawns, and mollusks. It is caught only with hand lines and in 15 to 50 fathoms of water. As the fish are hauled up from these considerable depths the rapid decrease in external pressure permits the air-bladder to expand and the stomach is often forced out into the mouth of the fish and the stomach contents thrown out upon the deck of the smack. Among the material thus ejected may frequently be seen specimens of small fish or crustaceans still alive and only very slightly injured. In this way have been obtained the types of several new fishes and good specimens of many rare species. The stomach of the specimen painted for this report contained one *Olivia* shell and the partially digested body of a *Trachurops crumenophthalmus.*

There is considerable sport in catching the red snapper. The line used is the size of an ordinary chalk-line; at its lower end is a sinker weighing about 3.5 pounds, consisting of a piece of lead shaped like a frustum of a cone, with the lower end hollowed out and filled with a mixture of lard and wax, for the purpose of determining the character of the bottom, as some of the sand, coral, shells, mud, or whatever the bottom is composed of, will stick to the wax and be brought up with it. On the line a few feet above the lead are attached two short lines, with hooks, not quite long enough to reach the lead. These hooks are baited with pieces of meat, bone-fish, lady-fish, or some other species. When a fish strikes, a quick jerk is given to fasten it and then the line is hauled in hand over hand. The red snapper does not ordinarily make any fight, but comes up as a dead weight until near the surface of the water, when, getting sight of the boat and fishermen, he becomes frightened and begins darting to right and left in the most frantic manner. The sport then is very exciting and, if the snapper be large, assistance may have to be called in order to finish the fight and lift the fish on deck. It sometimes happens that a fish is gotten on each hook at the same time.

Acara aya Marcgrave, Hist. Brasil., 167, 168, 1648, Brazil.
Bodianus aya Bloch, Ichthyol., 227, 1790, Brazil; after Marcgrave.
Bodianus ruber Bloch & Schneider, Syst. Ichthy., 330, 1801, Brazil: based on Marcgrave.
Mesoprion campechanus Poey, Memorias, II, 149, 1860, Campeche.
Lutjanus blackfordi Goode & Bean, Proc. U. S. N. M. 1878, 176, Pensacola.
Neomænis aya, Jordan & Evermann, l. c., 1264, 1898.

128. **Neomænis vivanus** (Cuvier & Valenciennes). *Pargo de lo Alto; Silk Snapper.*

Head 2.75; depth 3; D. x, 14; A. III, 8; scales (7) 8–72–17, 50 pores. Body rather slender, subelliptical, back not greatly elevated; profile very slightly convex from snout to nape, thence more arched; snout rather long and pointed, 3 in head; eye rather large, 4 in head; interorbital space slightly convex, 4.8 in head, occipital keel not very prominent; preorbital rather broad, 5.8 in head; mouth rather small; jaws subequal; maxillary reaching front of pupil, 2.5 in head; upper jaw with a narrow band of villiform teeth, outside of which is a single series of well-developed teeth; 4 moderate canines in front of jaw, the longest two about half diameter of pupil; lower jaw with a single series of rather large, unequal teeth, inside of which is a very narrow band of villiform teeth in front of jaw only; tongue with an oval patch of teeth, about twice as long as broad, in front of which is a roundish patch; no teeth on hyoid bone; pterygoids toothless; vomer with a broadly arrow-shaped patch of teeth, with a backward prolongation on median line somewhat longer than width of patch in front. Gillrakers slender, their length almost equal to half diameter of eye, about 11 developed below angle, in front of these about 5 rudiments. Preopercle with posterior limb slanting slightly downward and forward, with a broad and rather shallow emargination, its margin finely serrate above; coarser teeth at angle and on lower limb; posterior nostril oval. Scales very small, rows running obliquely upward and backward above lateral line, rows being almost horizontal; 7 rows of scales on cheek, 2 rows on interopercle, 1.5 rows on subopercle, and about 8 on opercle; temporal region with 1 row of large scales, behind which are smaller ones; top of head, snout, and jaws naked; bases of soft dorsal and anal scaly. Dorsal spines rather strong, outline of fin rather strongly convex and without deep emargination; fourth spine longest, 2.4 in head; tenth, 3.4 in head; margin of soft dorsal straightish, rounded behind, ninth ray longest, 1.33 length of first and two times last ray, 2.5 in head; caudal lunate, upper lobe slightly longer than lower, its length 1.5 times middle rays, which are 2 in head; margin of anal angulate, middle rays longest, 2 times length of last ray, 1.8 in head; first ray reaching almost to tip of last ray, when the fin is depressed; ventrals 1.66 in head; pectoral not quite reaching front of anal, 1.2 in head; second anal spine slightly longer than third, 3.25 in head.

Color in life: Bright rose-color, paler below, some narrow, undulating, light-golden streaks following rows of scales above lateral line; iris always bright-yellow (an important color-mark); mouth reddish within; traces of dark lateral spot in most specimens; dorsal rosy, its base pale, its edge yellow; caudal rosy, dusky behind, sometimes blood-red at tip; pectoral very pale yellow, ventrals and anal pale rosy, latter yellowish behind. The bright colors all fade and disappear in spirits. The scales of upper parts, in spirits, are marked with dark dots, which form streaks along rows of scales.

The above description verified on a specimen 14 inches long from Mayaguez.

West Indies; known from Cuba, St. Kitts, Martinique, and Porto Rico. A handsome species, rather common in the Havana markets, where it is known as pargo de lo alto. When fresh it may always be known by the bright-yellow color of the eye, a color which does not entirely fade in spirits.

The silk snapper was not common in the Porto Rican markets during our stay about the island, but Mr. Oscar Riddle says that it is quite common in the San Juan market at certain times. It is taken in the line fishery and is one of the most valued species. It is usually fished for in about 60 fathoms of water, and about a mile off Morro Castle. Five or 6 hooks are fastened with short snoods to a very tough, strong stick of native wood about 2 feet long, and this is weighted with heavy leads. In the center is fastened the strong hand-line with which it is lowered and raised. The hooks are usually baited with pieces of sardina (*Opisthonema oglinum*) or muniama (*Xystæma cinereum*). While the fish are being raised to the surface they are very often attacked by sharks. Our collection contains two specimens, 9.5 and 14 inches long, obtained in the market at Mayaguez.

Mesoprion vivanus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 454, 1828, Martinique.
Mesoprion profundus Poey, Memorias, II, 150, 1860, Cuba.
Lutianus torridus Cope, Trans. Am. Philos. Soc. 1869, 468, St. Kitts.
Lutjanus profundus Poey, Fauna Puerto-Riqueña, 320, 1881; Stahl, l. c., 76 and 162, 1883.
Neomænis vivanus, Jordan & Evermann, l. c., 1262, 1898.

129. **Neomænis analis** (Cuvier & Valenciennes). *Mutton-fish; Pargo Criollo; Pargo; "Sama."*

(PLATE 21.)

Head 2.7; depth 2.9; eye 5.67; snout 2.25; maxillary 2.8; mandible 2.3; interorbital 4.43; preorbital 3.5; D. x, 14; A. iii, 8; scales 10–70–18, about 51 pores. Body rather deep and compressed, back strongly elevated, profile steep and nearly straight from snout to nape; snout long and pointed; eye rather small; interorbital space gently convex; occipital keel moderate; preorbital very broad; mouth moderate, maxillary scarcely reaching front of orbit; upper jaw with a narrow band of villiform teeth, outside of which is a single series of larger but small teeth; 6 rather strong canines in front, 4 of them larger, about equaling in length half of diameter of pupil; lower jaw with a narrow villiform band in front only and a series of larger teeth outside; these unequal, largest on side of jaw, some of them almost canine-like; tongue with a single very small patch of teeth on its middle, this wanting in young examples; teeth on vomer forming a broadly Λ-shaped patch, without backward prolongation on median line. Gillrakers moderate, half length of diameter of eye, about 8 on lower arch, with no rudiments before them. Preopercle with its posterior margin almost straight, slanting gently downward and forward, notch broad and very shallow; edge of preopercle rather coarsely serrate, most so at angle; scales small, rows almost horizontal below lateral line, running backward and upward above; tubes of lateral lines branched; about 7 rows of scales on cheek; 1 row on interopercle, 1 on subopercle, and about 9 on opercle; temporal region with about 8 rows of scales, which become smaller posteriorly; bases of soft dorsal and anal scaly. Dorsal spines weak and slender, outline of fin not greatly curved, fourth spine longest, 2.66 in head, tenth spine 3.33 in head; margin of soft dorsal angulate, ninth ray longest, twice last and 1.5 times first ray, 2 in head; caudal well forked, upper lobe the longer, 1.6 length of middle rays, which are about 2.16 in head; anal angular, similar to soft dorsal, middle rays more elevated than in any other species, longest 2.25 length of last, 2 in head; first ray nearly reaching tip of last when fin is depressed; second and third anal spines rather strong, of equal length, 3.75 in head; ventrals 1.6 in head; pectoral reaching slightly past origin of anal, 1.3 in head.

Color in life: Dark olive-green above; many of the scales with pale-blue spots, these forming irregular oblique streaks upward and backward; similar stripes more regular and numerous on caudal peduncle and above anal. In old fishes these blue spots and streaks disappear; belly white, strongly tinted with brick-red; about 6 narrow, dusky, vertical bars, a little broader than interspaces and not well defined, between gill-opening and anal; head bronze-olive, darker above; a broad, undulating pearly streak from snout below eye to upper edge of gill-opening; a narrow blue streak from eye to nostrils; iris fiery red; pectoral, caudal, anal, and ventrals brick-red, caudal narrowly margined with black and little bronzed above; dorsal reddish along the rays and tips of membranes, otherwise yellowish; distinct lateral blotch just above lateral line and below first soft ray on dorsal, about as large as pupil, smaller than in other species similarly marked and seldom disappearing with age; axil and bar across base of pectoral above pale or dusky olive. In spirits the markings become fainter, the lateral blotch and bluish streaks on head usually persisting.

The above description of color from a specimen 11 inches long taken at Key West; Porto Rican examples appear to be somewhat more brightly colored. A fine specimen, 14 inches long, taken at Arroyo February 14, was, in life, pale-rosy, richest on sides, pale below; back olive-green with rosy wash; bases of scales brownish, edge with a pale-blue crescent; cheek and opercle rosy; an irregular blue line under eye; some blue in front and behind eye; top of head dark-reddish; chin and belly nearly white; fins all rosy, dorsal edged with lemon; upper caudal lobe yellowish. A specimen 8 inches long from San Antonio Bridge had side with narrow blue stripes and broader yellowish ones; cheek with 2 or 3 pale-blue stripes; belly rosy; ventrals and anal rosy; caudal greenish with slight rosy wash and dark edge; small dark spot under anterior dorsal rays; mouth pale inside.

This species ranges from Pensacola and Key West southward among the West Indies to Brazil, straying northward in the Gulf Stream to Woods Hole. Apparently one of the most abundant and important food-fishes of Porto Rico. Our collections contain specimens from San Juan, Mayaguez, Puerto Real, Ensenada del Boqueron, Ponce, Arroyo, Hucares, Fajardo, Vieques, and Culebra.

At Key West this species is called mutton-fish or pargo, and is one of the most important fishes brought to that market. It is said to reach a maximum weight of 25 pounds, though examples weighing more than 15 or 18 pounds are not common. The average weight of those seen at Key West or in Porto Rico probably did not exceed 5 pounds. It is said to be the most important food-fish of Havana, being always abundant. Its flesh is fairly flavored, though not very delicate. but always healthful. About Key West it is found on rock bottom in 3 to 9 fathoms, and is caught with hook and line. They are quite gamy, taking the hook promptly and fighting well. They are found throughout the year, but are scarcest in July and August, which is their spawning time. They are said to school at spawning time; the eggs are nonadhesive and the size of a rice grain.

In Porto Rico this species is highly esteemed. It is called "sama" or "pargo criollo." It is usually taken in the fish-traps set in 5 to 20 fathoms, though considerable numbers of the smaller individuals are caught with the haul seines in shallow water along the shore.

Mesoprion analis Cuvier & Valenciennes, Hist. Nat. Poiss., II, 452, 1828, Santo Domingo.
Mesoprion sobra Cuvier & Valenciennes, Hist. Nat. Poiss., II, 453, 1828, Martinique.
Mesoprion isodon Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 443, 1833, Santo Domingo.
Mesoprion roseaceus Poey, Ann. Lyc. Nat. Hist. N. Y., IX, 1870, 317, Cuba.
Lutjanus analis, Poey, Fauna Puerto-Riqueña, 330, 1881; Stahl, l. c., 76 and 162, 1883.
Neomænis analis, Jordan & Evermann, l. c., 1265, 1898.

130. **Neomænis megalophthalmus** Evermann & Marsh, new species.

Head 2.67; depth 2.9; eye 4.75; snout 2.85; maxillary 2.6; mandible 2.1; interorbital 6.25; preorbital 4.8; D. x, 12; A. iii, 8; scales 7–64–16, about 57 pores. Body oblong, compressed, back greatly elevated, anterior profile very steep and nearly straight or slightly concave from tip of snout to occiput, thence regularly convex to origin of dorsal fin; snout rather long and pointed; mouth large, maxillary reaching anterior third of pupil; lower jaw somewhat projecting; eye large; edge of preopercle nearly vertical, notch long and shallow, serrations obscure; teeth on vomer, palatines, and tongue, those on vomer in an Λ-shaped patch; patch on tongue long and narrow, truncate in front, narrowing behind; a narrow band of villiform teeth on upper jaw and 6 canines in front, one of these on each side much smaller than others; a row of moderately strong conic teeth in lower jaw; 10 gill-rakers on lower arm of first arch, longest about 2 in eye; scales moderate, those above lateral line in very oblique series; 6 rows each on cheek and opercle; temporal region with a broad band of scales arranged in several series; bases of soft dorsal and anal scaly; caudal well scaled; dorsal spines rather slender and weak, fourth to seventh longest, about 3.25 in head; second and third anal spines equal in length, second stronger, about equal to eye; caudal moderately forked, lobes equal, 1.6 in head; pectoral long, 1.25 in head, reaching origin of anal; ventrals about 2 in head.

Unfortunately, no life-color notes were taken of this species. In alcohol the type is olivaceous or grayish on back, with narrow pale-bluish lines following the rows of scales upward and backward; body below lateral line yellowish-white, with about 3 broad indistinct bluish lines near middle of side; a large black blotch, somewhat smaller than eye, just above lateral line and below first 4 dorsal rays, this spot smaller and less conspicuous than in *N. synagris*; preorbital bluish with traces of 2 narrow bronze lines running forward and downward from eye; fins all pale-lemon; iris yellow.

This species is related to *N. synagris*, but appears to differ in the larger eye, the greatly elevated back, longer pectoral, and in coloration. In *N. synagris* the upper caudal lobe is usually the longer, while in this species they are equal.

Type, No. 49531, U. S. N. M., 11.5 inches long, obtained at Puerto Real, Porto Rico, January 25, 1899, by Evermann & Marsh.

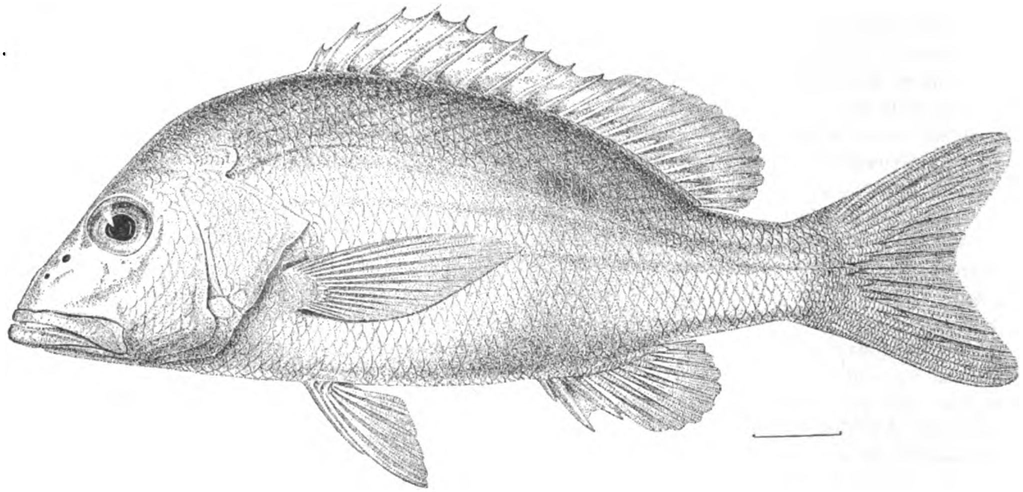

Fig. 48.—*Neomænis megalophthalmus.*

131. Neomænis synagris (Linnæus). *"Manchego"; "Mancheva"; "Raiado"; Lane Snapper.*

(Plate 22.)

Head 2.65; depth 2.75 to 3; eye 4.5 to 5; snout 2.5 to 2.8; maxillary 2.4 to 2.7; mandible 2 to 2.2; interorbital 5 to 5.75; preorbital 4.5 to 5; D. x, 12; A. III, 8; scales 7–64 to 68–15, about 50 pores. Body oblong, compressed, the back moderately elevated, profile almost straight from snout to nape; occipital keel little prominent; maxillary reaching front of orbit; upper jaw with a narrow band of villiform teeth, outside of which is a single series of enlarged teeth; 4 (rarely 6) rather small canines in front, 2 of them larger; lower jaw with villiform band in front only, single row of larger teeth nearly equal in size, none of them canines; tongue with a single oval patch, its length more than twice its width; vomer with a ∧ or shaped patch of teeth, without backward prolongation on median line, or with only a very slight one. Gillrakers rather long, their length slightly more than half diameter of eye, about 5 + 9, and usually no rudiments before them. Preopercle with its posterior margin slanting downward and forward, the emargination broad and moderately deep; preopercle rather finely serrate above, with coarser teeth at angle. Scales rather small, rows almost horizontal below lateral line, above somewhat undulate, running upward and backward; tubes of lateral line simple; 6 rows of scales on the cheek, 1 row on interopercle, 1 on subopercle, and 6 on opercle; temporal region with a broad band of scales, arranged in several series; base of soft dorsal and anal scaly; dorsal spines rather weak and slender, outline of fin gently convex; fourth spine longest, 2.66 in head, tenth spine 3.6 in head; soft dorsal short, its margin somewhat angulated, eighth ray longest, twice length of last ray and 1.5 first, 2.4 in head; caudal moderately forked, upper lobe the longer, 1.5 length of middle rays, which are 2 in head; anal rather high, rounded in outline, its middle rays longest, 1.66 length of last ray, 2.57 in head, first ray reaching middle of last ray when fin is depressed; second anal spine stronger than third and of equal length, 3.66 in head; ventrals 1.75 in head; pectoral reaching front of anal, 1.25 in head.

Color in life: Rose-colored, silvery-tinged below, slightly olivaceous but not dark above; a large, round, maroon blotch, larger than eye, just above lateral line and below front of soft dorsal, always present; series of stripes of deep golden-yellow along sides; 3 on head, upper from snout through eye; about 10 on body, lower nearly straight and horizontal, upper undulating and irregular, extending upward and backward; belly white, its sides largely yellowish; lips red; maxillary partly yellow; tongue yellowish; iris fiery red; caudal deep blood-red; spinous dorsal nearly transparent, with a marginal and basal band of golden; soft dorsal light-red, edged with golden; ventrals and anal golden; pectoral pinkish. Young quite green above. Similarly striped Cuban specimens are generally duller, with yellow stripes decidedly coppery. In spirits, the bright colors fade, only the lateral blotch and the streaks on the head being persistent.

Two specimens, each 8 inches long, from the market at San Juan showed the following colors: Bluish-olive on back, becoming paler on side; belly white; narrow irregular bars on back running upward and backward; side with about 7 broad orange or brassy lines, 1 above lateral line, next 2 running into it, others wholly below it; a large round black blotch, as large as eye, between lateral line and front of soft dorsal; dorsal edged with red; caudal reddish. Another specimen, 9 inches long, from San Antonio Bridge was, in life, rich-rosy, with 8 or 9 narrow orange or brassy lines on side, 4 or 5 of which extend on head, fourth from below uniting with fifth just behind opercular flap; dorsal pale-rosy, margined with lemon; caudal rosy, with a narrow black border; anal white on last rays, lemon anteriorly; pectoral very pale-rosy; ventrals pale-lemon; lips somewhat rosy.

The lane snapper is found from southern Florida southward to Colon and Brazil, and is usually abundant throughout its range. On the east coast of Florida it is known from Indian River and Biscayne Bay, and on the west coast from Pensacola southward. It is abundant among the Florida Keys, and is known from the Bahamas, Cuba, Martinique, Jamaica, Santo Domingo, and Porto Rico. Wherever known it is a food-fish of importance. Its maximum weight is about 4 pounds, though the average of those brought to the Key West market is not over half a pound. The largest seen in Porto Rico was 14 inches long and weighed about 2 pounds. Next to *Neomænis apodus*, it is the most abundant snapper in Porto Rico, and was obtained in the markets of San Juan, Mayaguez, and Ponce, our collections containing specimens from the following localities: San Juan, Mayaguez, Puerto Real, Ensenada del Boqueron, Fish Hawk station 6070 in Mayaguez Harbor in 220 fathoms, Ponce, Arroyo, Hucares, Isabel Segunda, and Culebra.

Salpa purpurescens variegata (Lane Snapper) Catesby, Hist. Nat. Carolina, pl. 17, 1743, Bahamas.
Sparus synagris Linnæus, Syst. Nat., X, 280, 1758, Bahamas; after Catesby.
Sparus vermicularis Bloch & Schneider, Syst. Ichth., 275, 1801, Martinique; on a drawing by Plumier.
Lutjanus aubrieti Desmarest, Prem. Déc. Ichth., 17, pl. 2, 1823, Cuba.
Mesoprion uninotatus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 449, 1828, Santo Domingo; Martinique.
Neomænis synagris, Jordan & Evermann, l. c., 1270, 1898.

132. **Neomænis mahogoni** (Cuvier & Valenciennes). "*Ojanco*"; *Mahogany Snapper*.

Head 2.5; depth 3; eye 3.75; snout 2.8; maxillary 2.3; mandible 1.9; interorbital 6; preorbital 6.5; D. x, 12; A. iii, 8; scales 8–63–14, about 50 pores. Body elongate, strongly compressed, back somewhat elevated, profile almost straight or slightly concave from tip of snout to nape, thence gently convex; snout rather slender and pointed; eye large; interorbital space somewhat convex; mouth large, maxillary reaching front of pupil; lower jaw strongly projecting; upper jaw with a narrow band of villiform teeth, outside of which is a single series of enlarged but comparatively small teeth; 6 canines on front of upper jaw, 2 of them small; lower jaw with a single series of rather uniform small teeth, none of them canine-like; tongue with an oblanceolate patch of teeth, tapering behind, its length more than twice its width; vomer with a broad, arrow-shaped patch of teeth, with backward prolongation on median line. Gillrakers moderate, about 10 developed on lower limb of arch, and 3 or 4 rudimentary ones; preopercle with its posterior margin almost vertical, broadly and rather deeply emarginate, very weakly or scarcely serrate above, angle projecting backward and armed with several rather coarse teeth, lower limb smooth. Scales rather small, those below lateral line somewhat larger, rows above lateral line running obliquely upward and backward, those below in almost straight horizontal series; cheek with 6 rows of scales, 1 row on interopercle, 1 on subopercle, and 7 on opercle; temporal region with a band of small scales, before and behind which is a series of larger ones; top of head, snout, and jaws naked; bases of soft dorsal and anal scaly. Dorsal spines rather weak and slender, outline of fin rather strongly convex, fourth spine longest, 2.57 in head; tenth spine 4 in head; margin of soft dorsal very gently convex, the first and last rays slightly shorter than rest of fin, median rays 3.33 in head; caudal not deeply forked, upper lobe little longer than lower, its length 1.4 in middle rays, which are 2.12 in head, margin of anal little rounded, the middle rays 1.66 length of last ray, 3 in head, first ray reaching almost to tip of last ray when fin is depressed; anal spines small, second as long as third and stronger, 4.4 in head; ventrals 2.2 in head; pectoral scarcely reaching front of anal, 1.33 in head.

Color in life: Deep brown, silvery below, everywhere shaded with red, especially on head; eye scarlet; a large blackish blotch on side, chiefly above lateral line and below first rays of soft dorsal; maxillary yellow on the covered parts; narrow bronze streaks following rows of scales, these streaks distinct, chiefly above the lateral line; dorsal fin pale, edged with blood-red; caudal deeply red; anal, ventrals, and pectoral scarlet. Bright colors fade and disappear in spirits, leaving the back dark-gray, lower parts silvery, more or less flushed with red.

An inhabitant of the West Indies; known from Cuba, Jamaica, Martinique, and Porto Rico; not known to occur in Florida, but said to be not uncommon in the Havana markets, where it is called "ojanco," in allusion to the large eye. It was seen by us only at Ponce, where a single specimen, 9 inches long, was obtained. This species does not reach a large size.

Mesoprion mahogoni Cuvier & Valenciennes, Hist. Nat. Poiss., II, 447, 1828, Martinique.
Mesoprion ricardi Cuvier & Valenciennes, Hist. Nat. Poiss., II, 447, 1828, Martinique.
Mesoprion ojanco Poey, Memorias, II, 150, pl. 13, fig. 10, 1860, Cuba.
Lutjanus ojanco, Poey, Fauna Puerto-Riqueña, 321, 1881; Stahl, l. c., 76 and 162, 1883.
Neomænis mahogoni, Jordan & Evermann, l. c., 1272, 1898.

Genus 78. OCYURUS Gill. Rabirubias.

This genus is allied to *Neomænis*, from which it differs notably in the structure of the skull, especially in the forward extension of the fronto-occipital crest to the ethmoidal projection; prefrontals with posterior areas short and excavated above and in front. The single species shows numerous minor peculiarities, as the peculiar form of body, the large, well-forked caudal fin, and the small head, as well as an increased number of gillrakers and the presence (in the adult) of pterygoid teeth.

133. Ocyurus chrysurus (Bloch). "*Colirubia*"; *Rabirubia; Yellow-tail.*

(PLATE 23.)

Head 3; depth 3; D. x, 13; A. iii, 9; scales 7–65–15, 51 pores. Body elliptical, comparatively elongate, back little elevated; profile straight from tip of snout to nape, thence rather strongly arched; caudal peduncle long and slender; snout pointed, of a moderate length, 3 in head; eye small, 5 in head; interorbital space very convex, with sharp median keel, 4 in head; preorbital narrow, its least width 6.66 in head. Mouth small, oblique, lower jaw projecting; maxillary reaching very slightly beyond front of orbit, 2.71 in head; upper jaw with narrow band of villiform teeth, outside of which is a single series of larger teeth, 5 or 6 of those in front being somewhat canine-like, but small; lower jaw with a single series of moderately strong teeth, none of them large enough to be called canines; tongue with a large, oval patch of teeth, in front of which is a smaller but similar patch; teeth on vomer forming a broadly arrow-shaped patch, with backward prolongation on median line, which is nearly twice width of patch; a narrow band of pterygoid teeth behind patch on vomer, this not evident in young examples. Gillrakers rather long and slender, longest about half diameter of eye, about 8 + 21, none of them rudimentary. Preopercle with its posterior margin almost vertical, with a slight but distinct emargination above angle; serrations of the preopercle very feeble, teeth at angle scarcely enlarged; nostrils well separated, posterior slit-like; scales small, those above the lateral line arranged in very oblique series, those below in rows nearly horizontal; cheek with 5 or 6 rows of scales, about 2 rows on interopercle; temporal region with 2 or 3 series of large scales, before and behind which are many small scales; top of head, snout, and jaws naked; bases of soft dorsal and anal scaly. Dorsal spines rather long and slender, fin not deeply emarginate, fifth spine longest, 2.4 in head; tenth spine 3.75; soft dorsal and anal similar, their margins nearly straight, last rays slightly shortened, median rays about 3 in head; caudal fin long, very deeply forked, upper lobe longest, three times as long as middle rays, which are 2.5 in head; pectoral long and slender, reaching vent, 1.12 in head; ventrals 1.57 in head; anal spines rather weak, the third a third longer than second, 4 in head.

Color in life: Olivaceous above, rather pale, and somewhat violet-tinged; a number of large, irregular, deep yellow blotches on sides of back; a deep yellow stripe from tip of snout straight through eye to caudal peduncle, there broadening and including all of tail above lateral line and behind dorsal fin;

above this a pearly-purplish area; below it a flesh-colored or rosy area or band, 2 scales broad, then a succession of about 16 narrow streaks alternately flesh-colored and yellow, growing fainter progressively below; yellow on edges of scales, reddish on their middles; iris fiery-red; lower parts of head flesh-color with some yellow spots; maxillary mostly yellow; caudal deep yellow, its edges reddish; dorsal chiefly yellow; anal faintly yellow; ventrals and pectoral translucent.

In spirits, all markings fade, leaving fins yellowish, upper parts grayish, lower rosy-silvery.

Found from southern Florida to Brazil, generally abundant; known from Biscayne Bay, Key West, Cuba, Martinique, St. Kitts, Jamaica, Porto Rico, and Brazil; at Key West, where it is called "yellow-tail" or "rabirubia," it is even more abundant than the lane snapper, and is the principal fish served at the Key West hotels and boarding-houses in the fall. It is said to be plentiful throughout the year except during the winter, when unusual cold may drive them away. During the warmer weather they are found at a depth of 2 fathoms or more, usually in about 5 fathoms, and generally about shoals where there is some mud bottom. The spawning time in Florida is said to be in July, when they are found about the reefs from Miami to the Tortugas.

In Porto Rico this fish is called "colirubia," and is an abundant and important food species. It was seen by us at most of the places visited, and specimens are in the collection from Mayaguez, San Antonio Bridge, Puerto Real, Ensenada del Boqueron, Ponce, Arroyo, Hucares, Fajardo, Culebra, and Isabel Segunda. Mr. Gray's collection from San Geronimo also contains several.

This species attains a length of about 2 feet and a weight of 3 or 4 pounds or more, and is quite gamy. The average weight of those seen at Key West was probably not over a pound. Those seen in Porto Rico were somewhat larger. At Key West they are caught with hook, using sardine bait.

Acara pitamba, Marcgrave, Hist. Brasil., 155, 1648, Brazil.
Rabirubia, Parra, Descr. Dif. Piezas, Hist. Nat., pl. 20, fig. 1, 1787, Cuba.
Sparus chrysurus Bloch, Ichthyol., pl. 262, 1790, Brazil; after Marcgrave.
Anthias rabirubia Bloch & Schneider, Syst. Ichth., 309, 1801, Cuba; after Parra.
Sparus semiluna Lacépède, Hist. Nat. Poiss., IV, 141, 1803, Martinique: on a copy of a drawing by Plumier.
Mesoprion aurovittatus Agassiz, Spix, Pisc. Brasil., pl. 66, 1829, Brazil.
Ocyurus rijgersmai Cope, Trans. Am. Phil. Soc. 1871, 468, St. Kitts.
Ocyurus Poey, Fauna Puerto-Riqueña, 321, 1881.
Ocyurus chrysurus, Jordan & Evermann, l. c., 1275, 1898.

Genus 79. RHOMBOPLITES Gill.

This genus is closely allied to *Neomænis*, but cranial peculiarities and extension of villiform teeth over pterygoid and hyoid bones well warrant generic separation. Form of vomerine patch of teeth is also somewhat peculiar. Prefrontals with articular facets developed from simple tubercles and not V-shaped, posterior areas cribriform; basisphenoid not lobigerous; pterygoid with a broad patch of teeth (in adult); hyoid bones and tongue with teeth; canines very small or obsolete; dorsal spines 12, soft rays 10 or 11; gillrakers slender and numerous. But one species known.

134. **Rhomboplites aurorubens** (Cuvier & Valenciennes). *Cagon de lo Alto.*

Head 3; depth 3; eye 3.4; snout 3.9; maxillary 2.7; mandible 2.2; interorbital 4; preorbital 8.5; D. XII, 11; A. III, 8; scales 8–68–16, about 50 pores. Body elongate, irregularly elliptical, the back not greatly elevated, highest at nape; profile regularly and strongly convex from above eye to spinous dorsal; snout rather short and bluntish, its upper profile straight and steep; eye very large; interorbital space very convex; preorbital narrow; mouth small, oblique, lower jaw somewhat projecting; maxillary scaleless, reaching front of orbit; upper jaw with a broad band of villiform teeth, outside of which is a row of enlarged, but comparatively small teeth; no canines; lower jaw with one series somewhat stronger than outer teeth of upper jaw; inside of these is a rather broad villiform band of teeth in front of jaw only; tongue with a very broad irregularly ovate patch of teeth, its width almost as great as width of tongue, 1.5 in its length; in front of this patch is a large roundish patch of teeth; an oblong patch of teeth on hyoid bone; vomer with a rhomboid (◇-shaped) patch of teeth, forming almost a right angle in front, with a broadly wedge-shaped backward prolongation on median line, its length about twice its width; palatine band of teeth very wide; pterygoids with a large patch of teeth, these teeth undeveloped and covered by skin in young examples. Gillrakers numerous, longest about half diameter of eye, about 6 + 21. Preopercle with posterior margin almost straight and vertical, slightly emarginate, weakly serrate above, teeth coarser at angle and on lower border; posterior nostril larger, nearly round.

Scales very small, rows above lateral line running upward and backward, rows below rather wavy, almost horizontal; temporal region covered with small partially embedded scales, in 4 or 5 rows; cheek with 7 rows of scales; 4 rows on interopercle, 3 rows on subopercle, and 7 on opercle; snout, preorbital, and jaws naked; top of head scaly to near middle of eye; soft dorsal and anal with but few scales at base. Dorsal spines long and slender, fourth spine longest, 2.9 in head, length of spines thence gradually decreasing to twelfth spine, which is 3.33 in head; margin of soft dorsal truncate, its rays of subequal length, 4.5 in head; last ray slightly shorter; caudal deeply forked, upper lobe longer than lower, its length 1.75 times middle rays, which are 2 in head; upper lobe of caudal 1.25 in head; anal similar to soft dorsal, its rays 3.4 in head; second anal spine shorter than third, 5 in head; ventrals 2 in head; pectoral somewhat falcate, reaching opposite vent, 1.4 in head.

Color in life: Vermilion, paler below; faint brown lines running obliquely forward and downward from dorsal along rows of scales; side with narrow sinuous streaks of golden-yellow, some of them longitudinal, others oblique; dorsal rosy, its margin chiefly orange; anal pale at base, rosy at extremity; pectoral yellowish, ventrals rosy, caudal and iris vermilion; inside of mouth dusky.

The bright colors grow faint or disappear in spirits.

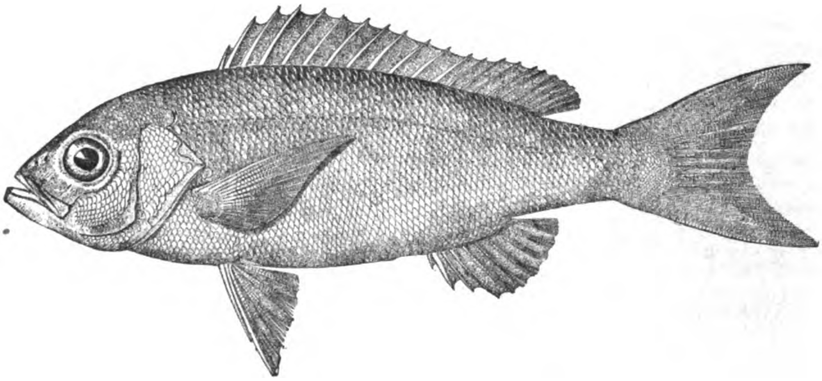

FIG. 49.—*Rhomboplites aurorubens.*

Charleston and Pensacola, south to Brazil; known from Pensacola, the "Snapper Banks," Cuba, Martinique, Santo Domingo, Jamaica, Porto Rico, and Brazil. Only a single specimen, 6 inches long, was obtained in Porto Rico. The species reaches a length of a foot and is a good food-fish.

Centropristis aurorubens Cuvier & Valenciennes, Hist. Nat. Poiss., III, 45, 1829, Brazil; Martinique; Santo Domingo.
Mesoprion elegans Poey, Memorias, II, 153, 1860, Cuba.
Aprion ariommus Jordan & Gilbert, Proc. U. S. N. M. 1883, 142, Pensacola; young with pterygoid teeth undeveloped.
Rhomboplites aurorubens, Jordan & Evermann, l. c., 1277, 1898.

Genus 80. ETELIS Cuvier & Valenciennes.

Body elongate, covered with large scales; eye very large; preorbital very narrow; mouth moderate, lower jaw projecting; canines in upper jaw only; no teeth on tongue or pterygoids; gillrakers long and slender. Dorsal fin deeply notched, rather short, its spines 10 in number, its soft rays not scaly; caudal very deeply forked; head naked above, skull with interorbital area flat, separated from occipital area by a transverse line, limiting median and lateral crests also; frontals wide in front, not cavernous, simply normally perforate; supraorbital margins crenate; periotic region little convex and with bones thick, unpolished; prefrontals behind, with funnel-shaped foramina.

The relationships of this interesting genus have been repeatedly misunderstood, but it belongs in the *Lutianidæ* and it has no special affinity with *Anthias*, *Perca*, or *Serranus*. Its synonymy and relations have been well discussed by Dr. Gill. In spite of the difference in form of dorsal, its relations with *Aprion* are very close. The skulls in the two are almost identical, as has been pointed out by Gill and by Poey. Two American species are known.

a. Maxillary scaly; depth 3.5 or more in length.................... *oculatus*, 135
aa. Maxillary naked; depth less than 3 in length.................... *aquilonaris*

135. **Etelis oculatus** (Cuvier & Valenciennes). "*Cachucho.*"

Head 3.5; depth 3.8; eye 3.4; snout 3.1; maxillary 2.1; mandible 1.7; interorbital 3.8; D. x, 11; A. III, 8; pectoral 1.1; ventral 1.5; caudal 0.8; scales 5–51–11. Body elongate, fusiform, not greatly compressed, caudal peduncle rather long and slender; scales large, regular, minutely ctenoid; top of head above eyes broad and flat, naked, skin somewhat rugose; top of head back of eyes with 2 lateral patches of scales, separated from those of body by a groove; cheek and opercles scaly, save preopercle, which is naked, its edge finely toothed; opercle ending in 2 weak, flat spines; eye very large; lower jaw projecting, maxillary reaching past front of pupil; teeth of upper jaw in a villiform band with an outer enlarged row and 1 or 2 pairs of strong forward-pointing canines in front; lower jaw with a row of conical teeth on sides, villiform ones in front, without distinct canines; vomer with villiform teeth, palatines with a row of stronger conical ones; ventral accessory scale not well developed; dorsal deeply notched; caudal scaly, widely forked.

Color: In life, bright-red nearly everywhere; in spirits, pale, the red nowhere persisting.

A handsome, edible species. Length 2 to 3 feet. West Indies to Madeira; not yet known from Florida; in rather deep water; generally common on rocky bottom.

One specimen, nearly 2 feet long, taken at Mayaguez.

Serranus oculatus Cuvier & Valenciennes, Hist. Nat. Poiss., II, 266, 1828, Martinique.
Etelis oculatus, Jordan & Evermann, l. c., 1282, 1898.

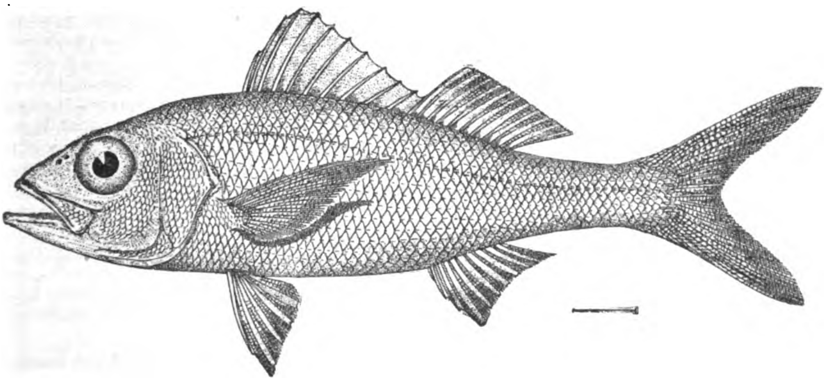

FIG. 50.—*Etelis oculatus.*

Family XLV. HÆMULIDÆ. The Grunters.

Body oblong, or more or less elevated, covered with moderate-sized, adherent scales, which are more or less strongly ctenoid or almost cycloid; lateral line well developed, concurrent with back, usually not extending on caudal fin; head large, crests on skull usually largely developed; no suborbital stay; mouth large or small, usually terminal, low, and horizontal; premaxillaries protractile, their spines not greatly produced backward; maxillary without supplemental bone, for most of its length slipping under edge of preorbital, which forms a more or less distinct sheath; preorbital usually broad; no barbels; teeth all pointed, none of them forming marked canines; no teeth on vomer, palatines, and tongue; lower pharyngeals separate, with pointed teeth; gills 4, a large slit behind fourth; pseudobranchiæ large; gillrakers moderate; gill-membranes separate, free from isthmus; preopercle serrate or entire; opercle without spines; sides of head usually scaly; dorsal fin single, continuous or deeply notched, sometimes divided into 2 fins, spines usually strong, depressible in a groove, heteracanthous, that is, alternating, one stronger on right side, other on left, usually 10 to 12 in number; anal fin similar to soft dorsal, with 3 spines; ventral fins thoracic, rays I, 5, with a more or less distinct scale-like appendage at base; caudal fin usually more or less concave behind; air-bladder present, usually simple; stomach cæcal; pyloric cæca few; vertebræ usually 10 + 14=24. Branchiostegals usually 6 or 7. Cranium with its muciferous system moderately developed or rudimentary. Intestinal canal short.

Carnivorous fishes of the warm seas, most of them valued as food. The family includes about 15 genera and nearly 150 species. It is very close to the *Lutianidæ* on the one hand and to the *Sparidæ* on the other, while some of its members show affinities with some *Sciænidæ* and *Serranidæ*.

a. Chin with a central groove behind the symphysis of the lower jaw.
b. Mouth more or less wide, the jaws scarlet posteriorly in life; soft parts of vertical fins densely scaly to their margins.
c. Scales above lateral line arranged in very oblique series, not parallel with the lateral line.
d. Jaws subequal, or the lower included; mouth little oblique; gillrakers comparatively few and short.
e. Dorsal spines 12, rarely 11; scales large; gillrakers few and small (10 to 14 on lower part of anterior arch); frontal foramen a single or divided slit at the base of the high supraoccipital crest in front.
f. Mouth moderate or large, its cleft more than one-third length of head; back more or less elevated; second anal spine strong, notably longer than third .... HÆMULON, 81
ff. Mouth small, its cleft less than one-third length of head; body rather elongate; second anal spine small; back and sides with longitudinal yellow stripes; teeth weak; gillrakers rather few and small; snout very short, 2.66 in head; frontal foramina separate and placed some distance in front of the very low supraoccipital crest; premaxillary spine very short, 4.25 in head .... BRACHYGENYS
ee. Dorsal spines 13; anal fin low; preorbital low; gillrakers in moderate or rather large numbers, 12 to 18 on lower part of arch; lower jaw not projecting; mouth little oblique; body comparatively elongate, the depth 2.75 to 3.5 in length; body with longitudinal yellowish stripes; scales rather small; frontal foramina long divided slits in front of supraoccipital crest; size small .... BATHYSTOMA, 82
bb. Mouth more or less narrow, not scarlet within; soft fins naked or with scales on their basal parts.
g. Anal fin short, its rays III, 7, to III, 10; dorsal fin more or less emarginate, its spines rather robust.
h. Body ovate, back elevated; depth greater than length of head; outer teeth of upper jaw enlarged; lips thick; second anal spine strong; soft rays of dorsal and anal scaly at base .... ANISOTREMUS, 83
hh. Body oblong, depth usually less than length of head; lips not very thick; scales large, those above lateral line in series mostly parallel with lateral line.
i. Preopercle very sharply serrate, serræ at angle much enlarged, those below angle turned forward; outer teeth in both jaws considerably enlarged; soft rays of dorsal and anal more or less scaly; second anal spine enlarged. CONODON, 84
ii. Preopercle finely serrate, serræ at angle scarcely enlarged, those below not antrorse; teeth subequal, or outer in upper jaw somewhat enlarged; gillrakers very short and weak.
j. Soft part of dorsal and anal with series of small scales on membranes behind each ray; anal spines small or moderate, second little, if any, longer or stronger than third; body oblong, not elevated; scales above lateral line parallel with back; dorsal spines 12, soft rays 15 or 16; outer teeth of upper jaw slightly enlarged. BRACHYDEUTERUS, 85
jj. Soft parts of dorsal and anal scaleless, except a low sheath at base; anal spines strong, second much longer and stronger than third; dorsal spines 12 or 13, the soft rays 11 to 14 .... POMADASIS, 86
gg. Anal fin long and low, its rays III, 10, to III, 13; dorsal fin low, usually not deeply emarginate; anal spines small; preopercle finely serrate or entire; outer teeth of jaws slightly enlarged; gillrakers moderate, rather slender.
k. Dorsal spines 12 or 13.
l. Scales of body without series of small accessory scales at base; soft dorsal and anal naked or somewhat scaly; mouth small; temporal crest, which rises from behind eye, very low and inconspicuous, upper edge below base of high supraoccipital crest, which originates over pupil .... ORTHOPRISTIS.
aa. Chin with pores, but with no central groove at symphysis; preopercle finely serrate.
m. Anterior profile concave above eye; snout gibbous; outer teeth in both jaws enlarged and blunt (appearance of *Anisotremus*); gillrakers small and slender; anal fin rather long, soft dorsal and anal scaleless .. GENYATREMUS.

Genus 81. HÆMULON Cuvier. The Grunts.

Body oblong, usually more or less elevated; mouth wide, maxillary long and curved, reaching to below eye, its tip extending to posterior end of preorbital; chin with a central groove behind symphysis; lower jaw included; gillrakers moderate; no teeth on vomer or palatines; teeth of jaws conical, outer series stronger, curved; lips and inside of mouth posteriorly commonly bright-red or scarlet in life; preopercle serrate, with no recurved hooks below; soft part of vertical fins completely covered with scales; scales above lateral line in series not parallel with it; a marked angle formed at junction of spinous and soft parts of dorsal; dorsal spines 12 or 11; second anal spine enlarged, generally larger and longer than third; caudal forked.

There are 12 or 13 species of *Hæmulon*, all of them American and all important food-fishes. They are of fair size, the flesh is firm and sweet, and they find a ready sale.

All the species have more or less of orange on inside of mouth, a trait of coloration not found in *Pomadasis*. The amount of redness is greatest in those species having the largest mouth. The young differ in proportion considerably from the adults. Besides the changes usual in other fishes, we may observe that in *Hæmulon* the young have the snout proportionately much shorter, so that the maxillary, although also much shorter in proportion, extends further back in comparison with the eye. Nearly all the species have, when young, at least two more or less sharply defined, dark, longitudinal stripes along the side, one or more along the top of the head, and a dark spot at the base of caudal. These markings persist longer in some species than in others, but traces of them at least may be found in the young of nearly all the species of *Hæmulon* and *Pomadasis*. In a few species these markings persist during life.

a. Scales below lateral line anteriorly not especially enlarged.

b. Scales above lateral line anteriorly not much enlarged.

c. Maxillary 2.33 to 2.75 in head, not reaching center of eye (in adult).

d. Back and sides without yellow or blue stripes; each scale above with a median blackish spot, these forming undulating lines (spots rarely obsolete in adult, obscure or wanting in young): maxillary 2.5 to 2.75 in head.

e. Scales in a vertical row from first dorsal spine to lateral line, 7 or 8 (9 in oblique series).

f. Mouth rather small, maxillary scarcely reaching to front of eye; back elevated; preorbital very deep, its least breadth greater than length of eye in adult, 4.12 to 4.66 in head in young; second anal spine not reaching to tip of last ray; snout long and pointed, 2.25 to 2.75 in head.

g. Sides without dark bars; head unspotted; dorsal spines graduated; second anal spine, when depressed, reaching beyond tip of last spine .... *album*, 136

ff. Mouth rather large, maxillary reaching front of pupil; back little elevated; preorbital rather narrow, its least width 5 in head; second anal spine reaching tip of last ray; snout rather long and pointed, 2.38 in head; back and sides with 4 or 5 black longitudinal streaks, which disappear only in very old examples .... *macrostomum*, 137

ee. Scales in a vertical row from first dorsal spine to lateral line, 5 or 6.

h. Series of scales from scapular scale extending backward to front of soft dorsal; snout rather long and pointed; mouth small; maxillary 2.75 to 3 in head; pectoral fin long, three-fourths length of head; black spots on sides coalescing in continuous stripes .... *bonariense*, 138

hh. Series of scales from scapular scale not extending farther backward than the middle of spinous dorsal; snout shorter, not very acute; mouth larger, the maxillary about 2.5 in head; premaxillary processes about 3 in head; dark spots on scales not coalescent.

i. Depth of body about 2.66 in length; pectoral fin short, less than two-thirds length of head; scales above lateral line scarcely enlarged. Head 3; depth 2.66; scales 6-50-14; D. xii, 17; A. iii, 7 .... *parra*, 139

dd. Back and sides with distinct horizontal yellow stripes, fading but not disappearing in spirits; no black spots anywhere; maxillary 2.33 in head, reaching front of pupil .... *carbonarium*, 140

cc. Maxillary nearly or quite half length of head, reaching center of eye in adult; no black spots or stripes anywhere in adult (except under angle of preopercle).

j. Back and sides with continuous yellow stripes, which are horizontal and do not everywhere follow the direction of the rows of scales; ground-color bluish-gray; back with a well-defined blackish area from first dorsal spine to base of caudal, this color covering most of soft dorsal and middle of caudal lobes; body rather elongate; snout moderate; second anal spine 2.75 in head. Head 3 .... *melanurum*

jj. Back and sides of head and body with continuous blue stripes, horizontal and not everywhere following rows of scales; ground-color bright-yellow; second anal spine 2.5 in head. Head 2.75 .... *sciurus*, 141

bb. Scales above lateral line anteriorly much larger than other scales .... *plumieri*, 142

aa. Scales below lateral line anteriorly much enlarged; head, back, and sides with continuous bright-yellow stripes, those below following direction of scales, and therefore extremely undulating for most part .. *flavolineatum*, 143

136. **Hæmulon album** Cuvier & Valenciennes. *"Vieja"; Jallao; Margate-fish; Margaret Grunt.*

(Plate 24.)

Head 2.7; depth 2.5; eye 6; snout 2.3; maxillary 2.5; interorbital 4; preorbital 4.4; scales 8-51-16; D. xii, 16; A. iii, 8; pectoral 1.6; ventral 1.8. Body comparatively deep, back elevated and compressed; anterior profile nearly straight, very slightly concave above eye; snout long and pointed; maxillary reaching front of eye; lower jaw included; teeth not large, those on sides of lower jaw more numerous and weaker than in *H. sciurus* or *H. plumieri;* interorbital space convex; preopercle finely serrate above angle; scales moderate, none of them much enlarged, in oblique series above lateral line, nearly horizontal below; soft fins scaly; dorsal spines moderate, fourth highest, 2.4 in head; caudal lobes subequal, 1.4 in head; second anal spine stronger and slightly longer than third, 3 in head.

Color in life, of adults: Pearly-white or rich olivaceous, especially above, where a few scales have very faint, dark spots at their bases; still fainter spots visible along scales of lower part of side; mouth orange within; lips and a faint blotch on each side of snout light yellow; a dusky shade under edge of preopercle (much more distinct in young); fins all light olive; soft dorsal somewhat dusky; head without stripes or spots. Young more distinctly spotted, spots small, round, blackish, each with a pearly edge; one under each scale of back and sides very distinct when the fish is alive, or after its scales are removed, but disappearing almost entirely with death. In life, a broad, dusky lateral band is also present, disappearing with death.

Found from Florida Keys to Brazil; known from Key West, Bahamas, Havana, Jamaica, Porto Rico, and St. Thomas; specimens obtained by us at Isabel Segunda.

The margate-fish is a common and important species at Key West. It reaches a weight of 8 or 10 pounds, the average being about 4 to 6 pounds. It is found in deep water, most abundantly on the reefs. It spawns early in summer, probably in July, on rock bottom, at which time it is said to school. One intelligent fisherman says, however, that it does not school at Key West, though it does in the Bahamas. It is generally found on rock or barry bottom, around shoals. At night it comes into more shallow water to feed—crabs, crawfish, worms, etc., constituting the bulk of its food. The bait used for it is crawfish or crabs. Cold is said not to affect this fish to any great extent. It does not appear to be very common about Porto Rico, but is highly esteemed. The largest obtained by us was 8.75 inches long.

The origin of the common name of the "margate-fish" is not generally understood. It appears, however, to have been derived from Margate, a well-known seaport and watering-place in England. Some of the fishermen of the Bahamas came originally from Margate and applied the name to one of the fishes which they found in the Bahamas. Many of these fishermen (Conchs) have come to Key West and brought the name with them. The name Margate is, at Key West, sometimes corrupted into "Margat" and "Margaret," while in Biscayne Bay it is "Margat," "Market," or "Margarite."

Perca marina gibbosa (Margate-fish), Catesby, Nat. Hist. Carolinas, etc., 2, pl. 2, 1742, Bahamas.
Hæmulon album Cuvier & Valenciennes, Hist. Nat. Poiss., V, 241, 1830, St. Thomas; Jordan & Evermann, l. c., 1296, 1898.

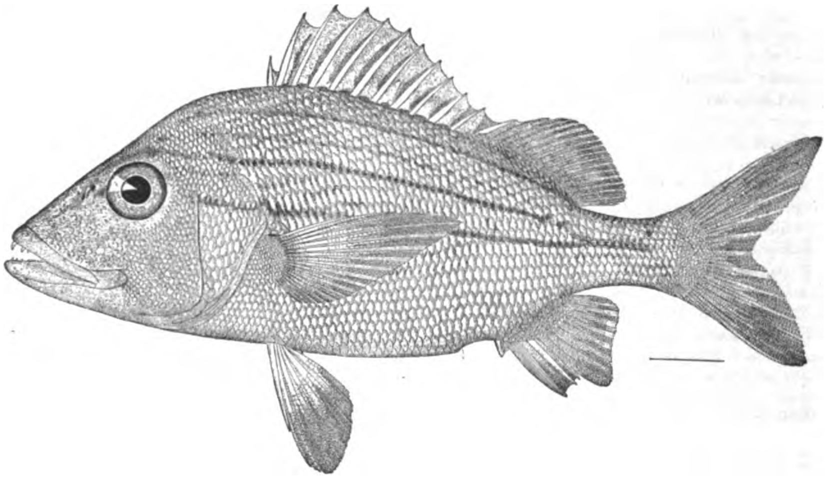

FIG. 51.—*Hæmulon macrostomum.*

137. **Hæmulon macrostomum** Günther. *Gray Grunt; Striped Grunt; "Corocoro."*

Head 2.75 to 2.8; depth 2.9; eye 4.33 to 5; snout 2.33; maxillary 2; interorbital 3.6; preorbital about 5; D. XII, 16; A. III, 8; scales 9-53-12; pectoral 1.4 in head; ventral 1.75 to 1.8. Body deep, compressed, back elevated in adult, profile nearly straight from tip of snout to occiput, thence gently curved to origin of dorsal; ventral outline straight; snout long and pointed, jaws subequal; mouth large, nearly horizontal, maxillary reaching middle of pupil. Teeth moderate, outer row in upper jaw and posterior teeth in both jaws considerably enlarged; preopercle finely serrate; gillrakers moderate; scales moderate, those above lateral line not enlarged, those below slightly enlarged on anterior part of body; scales above arranged in very oblique series, those below oblique anteriorly, becoming horizontal posteriorly. Dorsal spines strong, longest about 2.4 in head; soft dorsal high, longest rays 3 in head; caudal lobes subequal, lobes 1.5 in head; anal spines strong, second longest and strongest, 2.8 in head, not reaching past tip of last soft rays when depressed; soft anal high, its free edge concave, longest rays 2.5 in head and reaching beyond tips of last rays when depressed; caudal and soft parts of dorsal and anal densely and finely scaled; pectorals and ventrals with a few fine scales.

Color in life: Body dirty-silvery with about nine dark longitudinal streaks, plainest in young; a median stripe from snout to origin of dorsal; first and second lateral stripes extend from above eye to posterior end of soft dorsal, third begins on upper rim of orbit and extends to vertical of posterior end of soft dorsal where it joins fifth line; fourth line, which is usually indistinct, begins at eye, extends across opercle, and finally disappears on middle of side; fifth extends from eye along middle of side, crossing lateral line, where it is joined by third, then extending on caudal peduncle above lateral line to base of caudal fin; the remaining lines are on lower part of side and are more or less broken and irregular; head dark grayish-purple; an inky-black spot on inner lower edge of opercle; lower jaw flesh-color, with numerous fine dark specks; dorsal, caudal, anal, and pectoral yellow, with dusky wash on bases; ventrals dark; inside of mouth flesh-color. In larger individuals the dark streaks persist, but are less distinct.

Found in the waters of southern Florida and West Indies; known from Clearwater Harbor, Key West, Florida Keys, Indian River Inlet, Jamaica, St. Thomas, and Porto Rico. Probably not common in Porto Rico, as we obtained specimens only at San Juan and Arroyo. The largest of these was 10.5 inches long. The life-colors in the above description were taken from a specimen 6.5 inches long, obtained at Arroyo.

Hæmulon macrostoma Günther, Cat., I, 308, 1859, Jamaica.
Hæmulon fremebundum Goode & Bean, Proc. U. S. N. M. 1879, 340, Clearwater Harbor, Florida.
Hæmulon macrostomum, Jordan & Evermann, l. c., 1296, 1898.

138. **Hæmulon bonariense** Cuvier & Valenciennes. *"Ronco Prieto"; "Arrayado"; Black Grunt.*

Head 2.8; depth 2.6; scales 5–44–10; D. XII, 16; A. III, 8. Body oblong, compressed, the back considerably elevated; head rather long; snout pointed, rather longer and sharper than in *H. parra*, anterior profile straight, or a little concave before eyes. Snout 2.66 in head (in young of 9 inches). Mouth rather small, smaller than in *H. parra*, maxillary barely reaching front of eye, its length 3 in head. Teeth of moderate size, outer and posterior somewhat enlarged. Eye moderate, 4.66 in head; interorbital space flattish, its width 4.25 in head; preorbital moderate, its least width 4.8 in head; preopercle moderately serrate. Gillrakers few and small, about 12 on lower part of arch. Scales larger than in *H. parra* or any other of the genus, those above and below lateral line about equal in size, those above arranged in series which are less oblique and more undulating than in related species, the series from scapular scale following direction of lateral line for about 10 scales, then turning abruptly, reaching base of last dorsal spine, or sometimes anterior part of soft dorsal; soft fins scaly as usual. Dorsal spines of moderate strength, fourth 2.6 in head; longest ray of soft dorsal 4 in head; caudal 1.66 in head; anal high, second spine and longest rays extending, when depressed, well beyond tip of last ray; longest soft ray 2.75 in head; second spine longer and stronger than third, 2.66 in head; pectorals long, 1.33 in head; ventrals 1.75.

Color in spirits, pearly-gray; center of each scale brownish-black, these coalescing and forming very sharply defined continuous undulating stripes; about 16 of these between front of dorsal and front of anal; sixth extending from scapular scale to last dorsal spine; base of caudal blackish; fins dusky.

This species is found in the West Indies south to Buenos Ayres; not very common. It is not common about Porto Rico, only 2 specimens being obtained, both in San Juan market. It reaches the length of a foot or less, and is of some value as a food-fish.

Hæmulon canna Cuvier & Valenciennes, Hist. Nat. Poiss., V, 233, 1830, Martinique; not of Agassiz, 1829.
Hæmulon bonariense Cuv. & Val., Hist. Nat. Poiss., V, 254, 1830, Buenos Ayres: Jordan & Evermann, l. c., 1297, 1898
Hæmulon notatum Poey, Memorias, II, 179, 1860, Cuba.
Hæmulon retrocurrens Poey, Repertorio, II, 236, 1868, Cuba.
Hæmulon continuum Poey, Enum., 46, 1875, Cuba; Poey, Fauna Puerto-Riqueña, 325, 1881; Stahl, l. c., 77 and 163, 1883.

139. **Hæmulon parra** (Desmarest). *"Arrayado"; "Ronco"; Sailor's Choice.*

Head 3; depth 3; eye 4.4; snout 2.4; interorbital 4; preorbital 4.8; D. XII, 17; A. III, 8; scales [illegible]–54–12; pectoral 1.6; ventral 1.8. Body comparatively deep, back compressed and arched; anterior profile rather steep and convex, nearly straight from tip of snout to opposite front of eye, from which point to origin of dorsal fin, it is gently and regularly arched; back from origin of dorsal to caudal peduncle a uniform long curve; ventral line of body from tip of lower jaw to anal fin nearly straight; caudal peduncle compressed, its narrowest width 3 in its least depth. Mouth moderate but slightly oblique, gape 3 in head; lower jaw slightly shorter; maxillary reaching somewhat past front of eye. Teeth small, in villiform bands, those of outer series on sides of lower jaw somewhat enlarged; no antrorse teeth. Interorbital space convex; preopercle scarcely roughened, wholly without serrations; gillrakers short and not very stout, about 15 on lower arm of arch. Squamation very complete, all soft fins densely and finely scaled; scales of body rather large, those above lateral line somewhat enlarged anteriorly, running in very oblique series, series from humeral scale terminating under eighth dorsal spine; scales below lateral line in more nearly horizontal series, those on anterior part of body somewhat enlarged; lateral line arched, approximately parallel to dorsal outline, but very gently approaching it posteriorly. Dorsal spines strong, fourth to sixth longest, fin, when depressed, being inclosed in a groove by the sheathing scales; first anal spine quite small, second large and strong, much stronger but scarcely longer than third, their points not reaching tips of last soft rays when depressed; free end of soft anal slightly emarginate; caudal lobes subequal, their length about 1.66 in head; pectoral rather short and broad, reaching slightly past tips of ventrals; ventrals short, their tips acutely rounded.

Color in spirits, dark-brown; center of each scale on upper parts of body dark-brown surrounded by silvery, free edge of scale paler or purplish-brown; lower part of side and under parts more silvery, but with numerous fine dark punctulations everywhere; head dark; fins all dark.

The range of this fish extends from southern Florida through the West Indies to Brazil; it is recorded from the Tortugas, Key West, Cards Sound, Marco, Lemon Bay, and Biscayne Bay in Florida, and from Havana, Jamaica, Porto Rico, and Brazil. It is abundant about Key West. It collects into schools in July and August, at which time it spawns on rocky bottom. It reaches a weight of 2 pounds, the average being about half a pound, and is a valuable food-fish. The best fishing for this species is in summer. The single specimen obtained in Porto Rico is from Puerto Real, and is 10.5 inches long. It is probably not uncommon at the west end of the island.

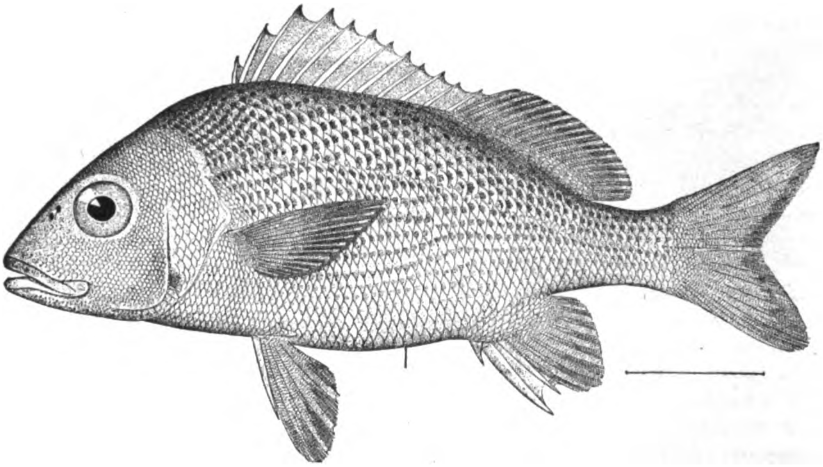

FIG. 52.—*Hæmulon parra.*

Diabasis parra Desmarest, Prem. Déc. Ichth., 30, pl. 2, fig. 2, 1823, Havana.
Hæmulon caudimacula Cuvier, Règne Animal, ed. 2, vol. 2, 176, 1829, Brazil: Havana.
Hæmulon chromis Broussonet MS. in Cuvier & Valenciennes, Hist. Nat. Poiss., V, 242, 1830, Jamaica.
Hæmulon acutum Poey, Memorias, II, 180, 1860, Cuba.
Hæmulon serratum Poey, Memorias, II, 181, 1860, Cuba; Poey, Fauna Puerto-Riqueña, 325, 1881; Stahl, l. c., 77 and 163, 1883.
Hæmulon albidum Poey, Memorias, II, 181, 1860, Cuba.
Hæmulon parra, Jordan & Evermann, l. c., 1297, 1898.

140. **Hæmulon carbonarium** Poey. *Ronco Carbonero.*

Head 3; depth 2.8; eye large, 3.66 in head; D. XII, 16; A. III, 8; scales 7–55–14. Body oblong; back not greatly elevated, profile nearly straight or slightly convex from tip of snout to above eye, thence gibbous to front of dorsal; snout short, moderately pointed, its length 3.16 in head; mouth not very large; gape somewhat curved; maxillary extending nearly or quite to front of pupil, its length 2.5 in head; lower jaw rather included. Teeth strong, much as in *H. sciurus*, but a little shorter. Interorbital space flattish, 4 in head; preorbital moderate, its least breadth 6 in head; preorbital finely but rather sharply serrate; gillrakers small, 9 + 14. Scales moderate, those below lateral line anteriorly moderately enlarged, their series nearly horizontal; series above lateral line very oblique. Dorsal spines slender and high, the fourth 1.87 in head; longest soft rays 3.5; upper caudal lobe a little longer than lower, 1.2 in head; longest anal rays 2.2 in head, their tips when depressed reaching beyond tip of last ray; second anal spine strong, 2 in head, its tip reaching when depressed about to tip of last soft ray; ventrals 1.5 in head; pectoral 1.3.

Color in life, light bluish-gray, much as in *H. plumieri;* body with 7 or 8 deep brassy-yellow stripes which are horizontal above, those below lateral line a little curved, following the rows of scales; stripes narrower than interspaces of ground-color; 3 stripes above lateral line, 3 or 4 below, the latter paler; little black under angle of preopercle; caudal blackish-yellowish at tip; soft dorsal, anal, and ventrals yellowish-gray, distal portion blackish; spinous dorsal bluish, deep yellow at base and edge; yellowish stripe along middle of fin; pectoral plain, yellowish bar across its base; mouth deep red, its angle dusky. In spirits, grayish, more or less shaded with dusky, the stripes rather faint orange-brown.

West Indies and the Bermudas, south to Brazil; very common at Havana. Length about 10 inches. One 8 inches long in Mr. Gray's collection from San Geronimo; not seen by us in Porto Rico.

Hæmulon carbonarium Poey, Memorias, II, 176, 1860, Cuba; Jordan & Evermann, l. c., 1300, 1896.

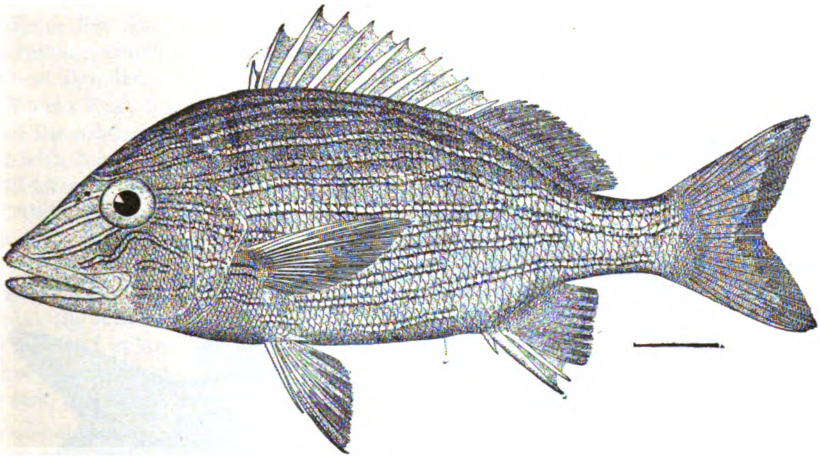

Fig. 53.—*Hæmulon sciurus.*

141. Hæmulon sciurus (Shaw). *"Ronco Amarillo"; Boca Colorado; "Cachicata"; Yellow Grunt.*

Head 2.66 to 2.83; depth 2.83 to 3; eye 4 to 4.75; snout 2.25 to 2.33; maxillary 2 to 2.1; interorbital 3.5 to 4.33; preorbital 6; D. xii, 16; A. iii, 8; scales 9–50 to 53–13 or 14; pectoral 1.5 to 1.43; ventral 1.75 to 1.86. Body oblong, back regularly and gently elevated, ventral outline nearly straight; snout rather long and pointed; mouth large, gape curved, maxillary usually reaching to vertical of front of pupil; lower jaw slightly included; teeth strong, upper jaw in front with about 3 strong canines on each side; front teeth of lower jaw rather strong; antrorse teeth of back part of each jaw rather strong. Scales moderate, those above lateral line not enlarged anteriorly, arranged in oblique series, those below slightly larger anteriorly, arranged in nearly horizontal series; lateral line gently arched in front. Dorsal spines moderate, fourth longest, about 2.5 in head; longest ray of soft dorsal about 4 in head; second anal spine strongest and somewhat longer than third, but not reaching tips of last soft rays when depressed; upper caudal lobe somewhat the longer; soft parts of dorsal, anal, and caudal densely scaled; pectoral and ventral less fully scaled; preopercle finely serrate; gillrakers short and slender, about 17 below angle of first arch.

General color in life: Yellowish, side with about 10 broad, brassy bands alternating with somewhat narrower pale-blue bands, fourth of which runs forward across upper edge of orbit, crosses forehead and joins its fellow from other side; cheek and snout with similar blue lines, the one on middle of cheek forking below eye and inclosing an oblong area of ground-color; spinous dorsal pale-yellowish olive, bordered with orange; soft dorsal rusty-olivaceous, with orange border; caudal dusky at base, yellowish-olive on outer third; anal, greenish-yellow; pectoral and ventral, rusty-lemon or light-yellow; inside of mouth, except tips of jaws, blood-red.

The yellow grunt reaches a length of 18 inches and a weight of a pound or less and is a common and important food-fish from the Florida Keys to Brazil. It appears to be generally abundant about Porto Rico and was observed at most of the places visited. There are specimens in the collection from San Juan, Arroyo, Vieques Island, Culebra Island, Fajardo, Guanica, Puerto Real, and Ensenada del Boqueron; taken by Mr. Gray at San Geronimo. It has previously been recorded from Biscayne Bay, the Tortugas, Key West, and others of the Florida Keys, Cuba, Aspinwall, Bahia, and Jamaica.

At Key West this fish is known as "boar grunt" and is very plentiful, usually in schools on rock bottom. A Key West fisherman reports that he has often caught 500 to 600 in a single day; the best fishing is in August. The best bait is a long worm which the fishermen get from the stem of a tall grass which grows on the bars. Nothing could be learned concerning its spawning habits, except that it probably spawns in August. Cold is said to affect this species seriously.

Anthias formosus Bloch, Ichth., pl. 323, 1790, Antilles: not *Perca formosa* Linnæus, with which it has been identified; the latter is *Diplectrum formosum*.
Sparus sciurus Shaw, General Zoology, IV, pl. 64, 1803, Antilles; based on the description and figure of Bloch.
Hæmulon elegans Cuvier, Règne Animal, ed. 2, vol. 2, 175, 1829; no description; based on Bloch's figure.
? *Diabasis obliquatus* Bennett, Zool. Journ. London, V, 1835, 90, Jamaica.
? *Hæmulon similis* Castelnau, Anim. Nou. et Rares, II, 1855, Bahia.
Hæmulon luteum Poey, Memorias, II, 174, 1860, Cuba; Poey, Fauna Puerto-Riqueña, 325, 1881; Stahl, l. c., 77 and 163, 1883.
Hæmulon multilineatum Poey, Memorias, II, 178, 1860, Cuba; Stahl, l. c., 163, 1883.
Hæmulon hians Haly, Ann. Nat. Hist., XV, 1875, 268, Aspinwall.
Hæmulon sciurus, Jordan & Evermann, l. c., 1303, 1898.

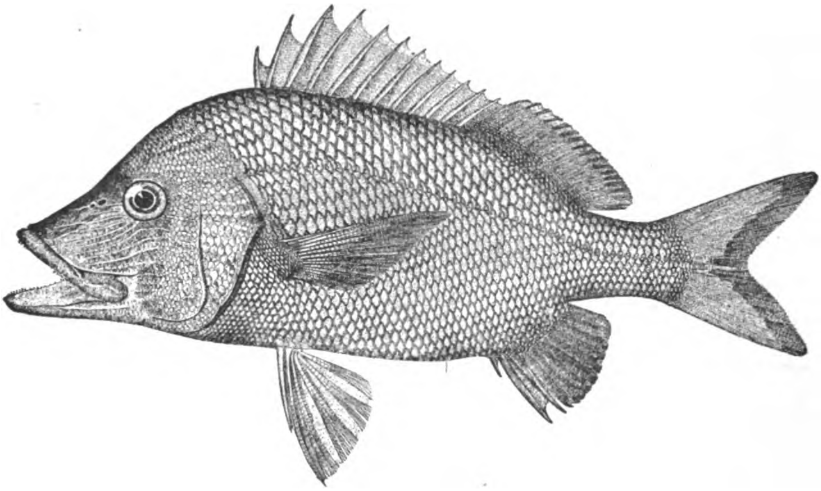

FIG. 54.—*Hæmulon plumieri.*

142. Hæmulon plumieri (Lacépède).

"Cachicata"; "Boca Colorado"; Ronco Ronco; Ronco Arará; Common Grunt.

Head 2.5 to 2.8; depth 2.43 to 2.66; eye 4.5 to 5; snout 2.16; maxillary 2; interorbital 3.2 to 4; preorbital 5 to 5.8; D. XII, 15 or 16; A. III, 8 or 9; scales 6–51–17; pectoral 1.5 to 1.8; ventral 1.75 to 1.8. Body moderately elongate, back considerably elevated and compressed; head long, snout sharp and projecting; anterior profile more or less S-shaped, nearly straight from tip of snout to front of eye, there concave, thence gibbous to front of dorsal, this character more pronounced in adults; mouth very large, gape curved, maxillary nearly reaching middle of eye; jaws subequal, or lower slightly included; teeth strong, in rather broad bands, those of outer series enlarged; antrorse teeth of posterior part of each jaw strong; interorbital space convex; preopercle finely serrate; gillrakers small and rather weak, about 12+15; scales rather large, those above lateral line very much enlarged anteriorly, arranged in irregular and very oblique series; those below lateral line but slightly enlarged anteriorly and in oblique series. Dorsal spines stout, third to fifth longest, about 2.5 in head, longest soft ray about 4.5; first anal spine very short, as usual, second long and strong, 2.4 in head, scarcely reaching tips of last soft rays when depressed and scarcely longer than third; soft portion of anal slightly concave, anterior rays longest, about 2.5 in head; upper caudal lobe the longer, 1.4 in head; pectoral long and somewhat falcate, about 1.33 in head; ventrals long, about 1.57 in head; caudal and soft parts of dorsal and anal densely and finely scaled, few scales on pectorals and ventrals.

Color in life: General color light bluish, series of scales each with a small brown or brassy spot, these forming narrow indistinct lines running upward and backward; above the lateral line the body of each scale is bluish, the border brownish olive; a brassy band along lateral line; back with some bronze; under parts whitish; about 12 narrow, irregular bright-blue lines on head, separated by broader brassy lines, these lines sometimes extending upon body; inner edge of maxillary orange; lower anterior edge of opercle yellow; inside of mouth red or deep yellow; lips dusky; dorsal grayish, with a narrow yellow edge on spinous portion; caudal plain gray; anal gray, tinged with yellow.

Color in spirits: Body pale-grayish with slight bluish iridescence on terminal borders of scales; bases of scales above lateral line brown; under parts paler; head purplish, blue lines persistent but duller, the brassy entirely faded; bright color of inside of mouth also faded.

The range of this species is from Cape Hatteras and Pensacola south to Brazil, on sandy shores. It is par excellence "the grunt" of our South Atlantic States and Florida. About Porto Rico it is one of the most abundant and valuable food-fishes. Numerous specimens were obtained at San Juan, Mayaguez, Puerto Real, Boqueron, Guanica, Ponce, Arroyo, Hucares, Isabel Segunda, and Culebra. It was one of the most common species in all the markets of the island. It is caught either in the fish-traps or with haul seines. In our seining about the island this was the species most frequently taken, particularly on sandy shores. At Key West it is the most abundant of all the food-fishes, and is caught all the year round, the best season being during the fall. Their spawning season is during August and September, at which time they gather up into schools on shoal, feathery, rock bottom, where they spawn. Each roe is from 1 to 2 inches in length. The eggs are said to be "gritty" to the touch and about the size of a No. 10 shot. When ripe they separate and flow freely from the fish. After spawning the schools break up and the fish scatter. They are so abundant, however, that they can usually be found in large numbers on suitable bottom, the best fishing being on rock bottom. These fish grow to about 18 inches in length, with a maximum weight of 4 pounds; but those over 2 pounds are rare, and the average weight does not exceed one-third of a pound.

Guabi coara brasiliensibus, Marcgrave, Hist. Brasil., 163, 1648, Brazil.
Perca marina capite striato (the Grunt), Catesby, Hist. Carolina, pl. 6, 1743, Bahamas, etc.
Labrus plumieri Lacépède, Hist. Nat. Poiss., III, 480, pl. 2, fig. 2, 1802, Martinique; on a copy of a drawing by Plumier.
Hæmulon formosum Cuvier, Régne Animal, ed. 2, II, 175, 1829, Martinique.
Hæmulon arcuatum Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 481, 1833, Charleston, S. C.
Hæmulon arara Poey, Memorias, II, 177, 1860, Cuba.
Hæmulon subarcuatum Poey, Memorias, II, 419, 1860, Cuba; a specimen with blue bands on anterior half of head only.
Hæmulon plumieri, Jordan & Evermann, l. c., 1304, 1898.

143. Hæmulon flavolineatum (Desmarest). *Ronco Condenado; French Grunt; Open-mouthed Grunt.*

Head 2.8; depth 3; eye 3; snout 3; maxillary 2.5; interorbital 3.5; scales 7–50–11; D. xii, 14; A. iii, 8. Body oblong-ovate, compressed, back not much elevated, profile from tip of snout to nape nearly straight, thence gently arched to origin of dorsal; mouth large, nearly horizontal, gape curved, maxillary nearly reaching middle of pupil; teeth moderate, outer somewhat enlarged; antrorse teeth in posterior part of each jaw considerably enlarged, those of upper jaw canine-like. Scales large, those on anterior part of body below lateral line considerably enlarged; rows of scales above lateral line running very obliquely upward and backward, those below somewhat wavy, most of them forming a curve with convexity downward and backward. Fins all moderate; dorsal spines slender, rather weak, longest about 2 in head; second anal spine longest and strongest, about 1.8 in head, its tip, when depressed, extending beyond tip of last ray.

Color in life: Side with about 12 irregular brassy lines alternating with about same number of similar pale-bluish lines, upper brassy lines rather dark, middle ones brightest and broadest, the broadest two uniting at gill-opening and running across opercle as one brassy line; anterior edge of opercle bright indigo-blue.

The above description based upon young individuals 2.5 to 4 inches long. The color of larger individuals, from Havana, has been described as follows: Light bluish-gray as ground color; a bronze-yellow spot on the upper part of each scale, these forming continuous undulating stripes on the whole body and head, wider than the interspaces of ground-color, and nearly straight on caudal peduncle, on anterior part of body below lateral line broader and very oblique; a horizontal golden-yellow stripe, crossing the others, runs alongside of back from occiput to last rays of soft dorsal; yellow around eye; yellow shades and streaks on cheek, not strongly marked as in *H. sciurus* and *H. plumieri;* yellow stripes on top of head; angle of mouth black, inside brick-red; a large black blotch under angle of preopercle; fins bright golden-yellow, the pectoral and spinous dorsal paler.

In spirits the ground-color becomes grayish and the stripes brownish or dusky.

The range of *H. flavolineatum* is from the Bermudas, the Florida Keys, and Tortugas south to Brazil. It is generally common in the West Indies and abundant about Porto Rico, usually on sandy shores. No adults were obtained, but numerous young from the following localities: San Antonio Bridge, Mayaguez, Puerto Real, Ensenada del Boqueron, Ponce, Arroyo, Hucares, and Culebra.

This well-marked species reaches a length of a foot and is a good food-fish.

Diabasis flavolineatus Desmarest, Prem. Décade Ichth., 35, pl. 2, fig. 1, 1823, Cuba.
Hæmulon heterodon Cuvier, Règne Animal, ed. 2, vol. 2, 176, 1829, Cuba.
Hæmulon xanthopterum Cuvier & Valenciennes, Hist. Nat. Poiss., V, 254, 1830, Martinique.
Hæmulon flavolineatum, Jordan & Evermann, l. c., 1306, 1898.

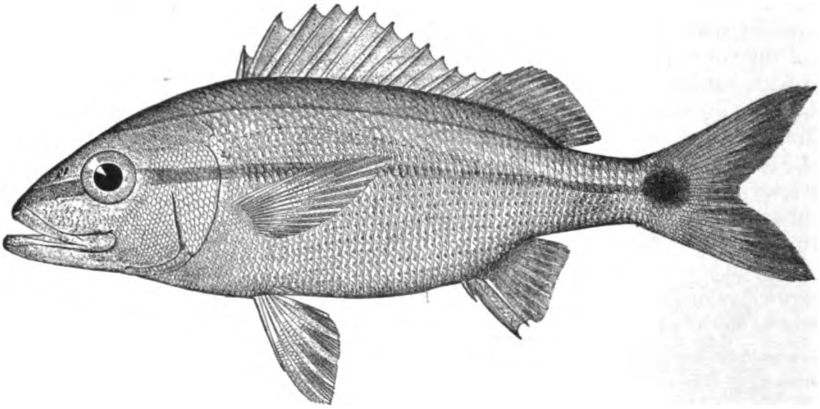

FIG. 55.—*Bathystoma rimator.*

Genus 82. BATHYSTOMA Scudder.

This genus differs from *Hæmulon* in having 13 dorsal spines; body rather elongate; gillrakers rather numerous, 12 to 18 on lower part of anterior arch; mouth moderate; scales small; frontal foramina long, divided slits in front of supraoccipital crest. Jaws red within.

a. Mouth large, maxillary reaching middle of eye, its length about one-half head; gillrakers rather short and few; scales moderate, 50 to 56 in lateral line; second anal spine scarcely larger or longer than third, 2.75 or more in head.
b. Body oblong, back moderately elevated, depth 2.75 to 3 in length .... *rimator*, 144
bb. Body subfusiform, back little elevated, depth 3.33 to 3.5 in length .... *aurolineatum*
aa. Mouth rather small, maxillary not reaching to opposite middle of eye, its length not quite one-half head; gillrakers numerous, rather long; scales small, about 70 in lateral line; second anal spine notably longer and larger than third; body more elongate than in other species, depth about 3.5 in length .... *striatum*, 145

144. Bathystoma rimator (Jordan & Swain). *Tom-tate; Red-mouth Grunt; Cæsar.*

Head 2.8; depth 3; eye 4.2; snout 2.5; maxillary 2; mandible 2.2; interorbital 3.7; preorbital 8; D. XIII, 15; A. III, 8; pectoral 1.5; ventral 2; scales 8–56–12. Body elongate, back somewhat elevated, anterior profile slightly convex; snout rather long, pointed; eye large; mouth large, maxillary reaching pupil; teeth not strong, outer series enlarged; scales rather small, in oblique series above lateral line, horizontal below and slightly enlarged anteriorly. Dorsal spines slender, fourth 2.4 in head; second anal spine equaling third in length, but much the stronger, 3 in head.

Color in life: Silvery white, slightly bluish above, with iridescent reflections; edges of scales of body light-yellow, these forming continuous light-yellow lines, those below lateral line horizontal, those above very oblique; besides these a narrow continuous streak of light yellow above lateral line from head to end of soft dorsal, and another from eye to middle of caudal; head silvery yellowish above; inside of mouth red; no black under preopercle; traces of black blotch at base of caudal; fins colorless, lower slightly yellowish.

The range of this fish is from Cape Hatteras and Pensacola southward through the West Indies to Trinidad. It is abundant about Charleston, S. C., where it is one of the most common food-fishes; adults said to be uncommon about Pensacola and Key West, but at the latter place the young swarm everywhere about the wharves and shores. It is as yet not known from Cuba, and does not seem to be at all abundant in Porto Rico, as it was seen only at Aguadilla, Ensenada del Boqueron, and Culebra Island. The specimens obtained are 5 and 6 inches long.

Hæmulon rimator Jordan & Swain, Proc. U. S. N. M. 1884, 308, Charleston, Key West, and Pensacola.
Bathystoma rimator, Jordan & Evermann, l. c., 1308, 1898.

145. Bathystoma striatum (Linnæus). *White Grunt.*

Head 2.8; depth 3.3; eye 3; snout 3.28; maxillary 3.16; mandible 2.75; interorbital 3.8; preorbital 8.3; scales 8–70–13; D. XII, 13, the longest spine about 2.2 in head; A. III, 7; pectoral 1.5 in head; ventrals 1.75; caudal 1.5. Body elongate, fusiform, back little elevated, anterior profile scarcely arched; head moderate, snout short and blunt; mouth small, maxillary reaching front of pupil; eye large; teeth small, outer series somewhat enlarged; interorbital wide, preorbital narrow; preopercle finely serrate; gillrakers numerous, long and slender, 7 + 20. Scales very small and crowded, those above lateral line in very oblique series, those below more nearly horizontal, none enlarged; soft parts of all fins densely scaled; spines slender and weak.

Color in alcohol: Pearly-gray, with 5 or 6 continuous brownish streaks (probably golden in life), 1 on median line from tip of snout to origin of dorsal, 1 diverging from snout and passing above eye and along side to soft dorsal; another from snout crosses upper part of eye and terminates near beginning of lateral line; a fourth passes through eye and along middle of side to base of caudal; another crosses opercle and base of pectoral.

This fish is known from the Bermudas, Key West, Cuba, Santo Domingo, and Porto Rico, but is apparently not common. It probably never exceeds a foot in length. We seined one specimen, 3.25 inches long, at San Antonio Bridge.

Perca striata Linnæus, Syst. Nat., ed. X, 233, 1758, North America.
Grammistes trivittatus Bloch & Schneider, Syst. Ichth., 188, 1801, Brazil: on the description of Marcgrave.
Serranus capeuna Lichtenstein, Abhandl. Berlin Akad. 1821, 288, Brazil: on the description of Marcgrave.
Hæmulon quadrilineatum Cuvier & Valenciennes, Hist. Nat. Poiss., V, 238, pl. 120, 1830, Santo Domingo.
Hæmulon quinquelineatum Poey, Memorias, II, 419, 1860, Cuba.
Bathystoma striatum, Jordan & Evermann, l. c., 1310, 1898.

Genus 83. ANISOTREMUS Gill.

Body ovate, short, deep, and compressed; mouth rather small with thick lips, maxillary rather short; inside of mouth not red; teeth in jaws only, all pointed, those of outer series in upper jaw enlarged; chin with a median groove besides smaller pores. Dorsal spines strong; soft rays of dorsal and anal scaly at base, anal spines strong; caudal mostly lunate; scales large; lower pharyngeals broad, with coarse, blunt teeth.

This genus, which is closely related to *Hæmulon*, contains 12 species, valued as food-fishes, all from the shores of tropical America and only two of which have been taken in Porto Rico. All of the species undergo considerable change in form with age. The young are marked with two or three blackish, lengthwise stripes. These disappear with age, quickest in the brightly colored species, but persist a long time in species like *A. bilineatus* and *A. interruptus*, which agree in coloration with *Hæmulon parra* and related species.

a. Scales above lateral line arranged in oblique series which are not parallel with it.

b. Scales comparatively large, less than nine in a vertical series between first dorsal spine and lateral line; coloration olivaceous, adult nearly plain, young with two or more dusky lateral stripes which disappear with age; fins blackish.

c. Scales 5 or 6-52-15 (lateral line with 49 pores); scales above lateral line on anterior part of body more or less enlarged, especially in adult.

d. Scales above lateral line not much enlarged, about 9 in an oblique series from first dorsal spine to lateral line; profile of head anteriorly rounded .... *surinamensis*, 146

cc. Scales 7 or 8-46-15 (lateral line with 54 pores); scales above lateral line anteriorly not especially enlarged... *bicolor*

bb. Scales rather small, more than 9 in a vertical series between first dorsal spine and lateral line.

e. Body not striped longitudinally with yellow or blue; preorbital narrow; gillrakers x + 13.

f. Anterior part of body with a black vertical bar.

g. Body with 2 lengthwise bands; humeral bar brownish; a dark caudal spot, and a spot on the back of the caudal peduncle .... *spleniatus*

ee. Body with longitudinal stripes of blue or yellow or both; young with a black blotch at base of caudal; preorbital broad; gillrakers x + 16.

h. Anterior part of body with 2 broad, dark crossbars, the one from nape obliquely forward through eye, other from front of dorsal downward; behind these a series of horizontal stripes alternately yellow and blue; pectoral longer than head; second anal and fourth dorsal spines nearly equal.

i. Blue stripes on side as broad as a scale, each more than two-thirds width of golden-yellow interspaces and each very faintly edged with darker; vertical bands on head and shoulder jet-black .... *virginicus*, 147

hh. Anterior part of body without dark crossbars, body sometimes plain yellowish, back usually violet with 4 or 5 yellow lines; silvery below; snout short, not longer than width of the eye; dorsal fin very deeply notched, with feeble spines; the second and third anal spines equal in length; the body a little more oblong than in *surinamensis* .... *serrula*

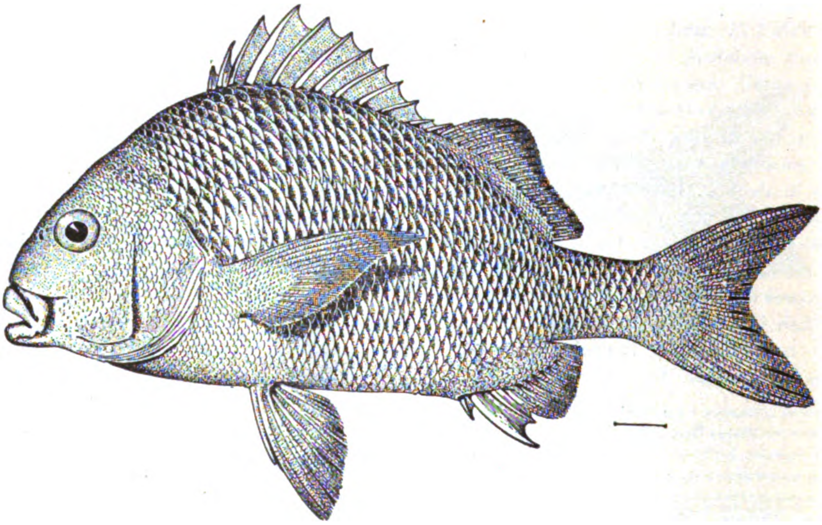

FIG. 56.—*Anisotremus surinamensis.*

146. Anisotremus surinamensis (Bloch). *Pompon.*

Head 3.14; depth 2.2; eye 4.5; snout 2.6; maxillary 3; D. XII, 16; A. III, 8 or 9; scales 5-50-13. Body deep, back elevated, greatly compressed; profile steep, nearly straight from snout to above eye, a slight depression in front of nostril and another in interorbital space; profile from interorbital space to dorsal strongly arched in a broad curve. Head moderate; cheek deep; mouth rather small; jaws subequal, maxillary barely reaching front of orbit; ventral line of body nearly straight; caudal peduncle moderately long, its least depth equal to snout; teeth in several bands, outer enlarged and canine-like. Fourth dorsal spine strongest and longest, its length 2.2 in head; soft dorsal as well as anal, pectoral, ventrals, and caudal densely covered with minute scales; height of longest soft dorsal ray 3 in head; second anal spine very stout, its length equal to that of fourth dorsal spine; third anal spine broad at base, but shorter than second; free edge of soft anal straight; dorsal and anal fins depressible in a scaly sheath; pectoral long and falcate, nearly reaching tip of ventrals, 1.2 in head; ventral shorter, 1.2 in pectoral; caudal well forked, the lobes about equal to ventral. Preopercle strongly but irregularly serrate. Scales of cheek in about 7 rows, those on opercle in about 8 rows, on interorbital and nape small and crowded; scales of back and sides arranged in oblique rows not parallel with lateral line, which is arched, following approximately contour of back. Gillrakers rather short, stiff, 13+19.

Color, grayish, darkest on anterior half of body, where each scale is dark-brown on its basal half, then with a white ellipse, narrow border darker, contrast between dark base and white ellipse very marked; owing to the irregular arrangement of scales the dark bases in some cases appear as spots; upper side of caudal peduncle brown, sides nearly plain white; snout and under parts of head lilac-brown; under parts of body rusty-brown; fins all dark brown, especially the soft parts of dorsal and anal.

The above description from a specimen 15 inches long, taken in Indian River, Florida.

The recorded range of this species is from the Indian River, Florida, and the Tortugas to Brazil; it is known from Surinam, Martinique, Porto Rico, Jamaica, and Cuba. It attains a length of 2 or 3 feet and is a good food-fish, though it is not sufficiently numerous anywhere to be of great importance. Only a single specimen, 2.4 inches long, seined at Ponce, was obtained in Porto Rico.

Lutjanus surinamensis Bloch, Ichth., pl. 253, 1791, Surinam.
Holocentrus gibbosus Lacépède, Hist. Nat. Poiss., IV, 344, 1803, Surinam.
Pristipoma bilineatum Cuvier & Valenciennes, Hist. Nat. Poiss., V, 271, 1830, Martinique.
Pristipoma melanopterum Cuvier & Valenciennes, Hist. Nat. Poiss., V, 273, 1830, Brazil.
Hæmulon obtusum Poey, Memorias, II, 182, 1860, Havana.
Hæmulon labridum Poey, Memorias, II, 419, 1861, Cuba.
Anisotremus surinamensis, Jordan & Evermann, l. c., 1318, 1898.

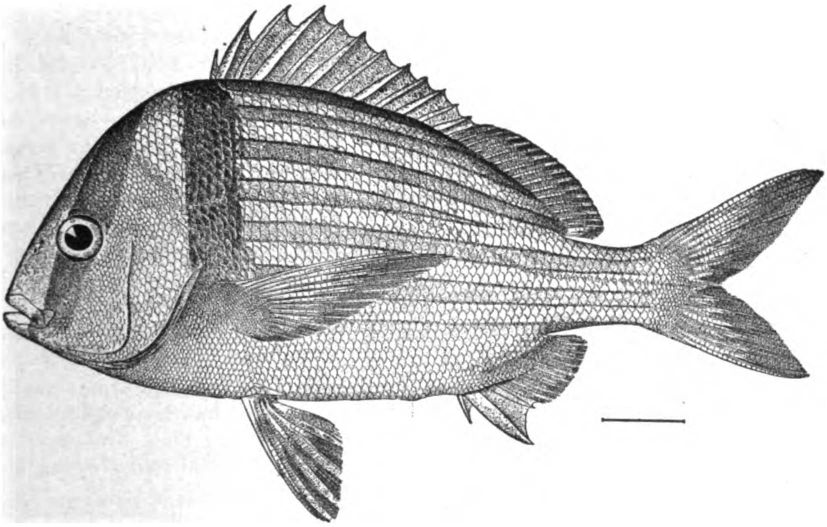

FIG. 57.—*Anisotremus virginicus.*

147. **Anisotremus virginicus** (Linnæus). "*Sisi*"; *Catalineta; Pork-fish.*

Head 3 to 3.2; depth 2 to 2.25; eye 3.75 to 4; snout 2.75; maxillary 3.25 to 3.5; interorbital 3; preorbital 4; scales 13–57 to 60–16; D. XII, 16; A. III, 9; pectoral a little longer than head; ventral 1.5; caudal lobe 1.2. Body ovate, back greatly elevated, anterior profile very steep, slightly convex along snout and over eye, very much arched on nape; highest point of body at origin of dorsal fin; mouth small, little oblique, maxillary extending to anterior edge of orbit; jaws subequal; outer row of teeth enlarged; gillrakers 11+11, short and not very stiff. Dorsal spines rather strong, longest (third) about 1.8 in head; dorsal rays short; second anal spine strongest and longest, about 2 in head; caudal well forked, lobes subequal; ventrals just reaching vent; pectoral long, somewhat falcate, reaching origin of anal. Scales large, strongly ctenoid, those on nape and breast reduced in size; scales above lateral line in oblique series.

Color in life: Side with about 8 broad, lemon-yellow lines alternating with similar lines of dirty silvery, the upper 3 or 4 of these yellow lines branch anteriorly, the fifth extending on middle of caudal peduncle; belly silvery-white; a broad black bar from origin of spinous dorsal downward to base of pectoral, the black continuing on shoulder-girdle to near isthmus; another broad black bar from occiput through eye to angle of mouth; cheek metallic or brassy-greenish; top of head brassy; fins all orange-yellow, spinous dorsal, pectoral, and ventral dusted with brownish; scaly sheath at base of anal rich yellow. In alcohol, the longitudinal stripes become bluish and the yellow fades.

This handsome fish ranges from Florida to Brazil. It is known from Biscayne Bay, Key West, Santo Domingo, Jamaica, Porto Rico, Martinique, and St. Catharine Island, Brazil, and is the commonest species of the genus in the West Indies. About Key West it is said to school from June to August, which is the spawning season, and is found then about the shoals, but soon retires to deeper water. It spawns all through the channel about the shoals, and is then caught in greatest numbers. About a month after the spawning season immense numbers of young are seen on the shoals. It reaches a length of about a foot and a weight of 2 pounds. The average weight of those brought to market probably does not exceed one-third of a pound. It does not appear to be very common about Porto Rico as only five examples were obtained—one at Ponce, one at Mayaguez, and three at Arroyo, where it was called "sisi" by the fishermen. It is regarded as a good food-fish.

Guatucupa juba, Marcgrave, Hist. Brasil., 148, 1648, Brazil.
Acara pinima, Marcgrave, Hist. Brasil., 152, 1648, Brazil.
Sparus virginicus Linnæus, Syst. Nat., X, 281, 1758, South America.
Sparus vittatus Bloch, Ichth., taf. 263, fig. 2, 1791, Brazil; after *Acara pinima* of Marcgrave.
Perca juba Bloch, Ichth., taf. 308, fig. 2, 1791, Brazil; after *Guatucupa juba* of Marcgrave.
Grammistes mauritii Bloch & Schneider, Syst. Ichth., 185, 1801, Brazil: after *Sparus vittatus* Bloch.
? *Pristipoma catharinæ* Cuvier & Valenciennes, Hist. Nat. Poiss., V, 269, 1830, St. Catharine Island, Brazil.
Pristipoma rodo Cuvier & Valenciennes, Hist. Nat. Poiss., V, 274, 1830, Brazil, Martinique, Porto Rico, and Santo Domingo.
Pristipoma acara pinima, Castlenau, Anim. Nouv. ou Rares, 8, 1856, Brazil.
Anisotremus virginicus, Poey, Fauna Puerto-Riqueña, 324, 1881; Jordan & Evermann, l. c., 1322, 1898.

Genus 84. CONODON Cuvier & Valenciennes.

This genus is close to *Pomadasis*, from which it is separated by the enlarged outer teeth and by the peculiar armature of the preopercle, which is very sharply serrate, serræ at angle enlarged, those before angle turned forward. Body oblong; soft rays of dorsal and anal more or less scaly; second anal spine large. Of the two species of this genus only one occurs in Porto Rico.

148. Conodon nobilis (Linnæus). "*Bureteado.*"

Head 3.25; depth 3.25; eye 4.1; snout 3.4; maxillary 2.8; mandible 2.25; interorbital 5.1; preorbital 5.3; D. XI-I, 13; A. III, 7; pectoral 1.4; ventral 1.5; caudal 1.4; scales 5-51-11. Body oblong, back elevated and moderately compressed, depth equal to length of head; mouth small, maxillary falling short of front of eye; lower jaw projecting; teeth in front of both jaws much enlarged, conic, short, but very stout; pectoral with about 10 short, sharp serrations on upper limb, lowermost, at angle of preopercle, much the strongest; antrorse serrations on lower limb; dorsal spines strong, a deep notch between them and soft dorsal; second anal spine longest and strongest.

Color in life: Back grayish, becoming paler on sides; belly white, silvery; top of head grayish; side with 8 broad, vertical dark bars, broadest above, gradually narrowing and disappearing below; interspaces broader, with brassy wash; some evidence of 2 pale brassy stripes below lateral line; side of snout, head, and tip of lower jaw pale-lemon; fins all with some yellow, ventral brightest.

This species is found on the coast of Texas, West Indies, and Brazil, not uncommon on sandy shores; recorded from Jamaica, Martinique, Brazil, and Texas; not rare in Porto Rico, where specimens were obtained by us at Arecibo, Mayaguez, Palo Seco, Ponce, Arroyo, and Vieques. It reaches a length of about a foot, but our examples range from 2.75 to 4.5 inches.

Perca nobilis Linnæus, Syst. Nat., ed. X, 191, 1758, North America.
Sciæna plumieri Bloch, Ichthyol., VI, 66, taf. 306, 1791, Martinique.
Sciæna coro Bloch, l. c., pl. 307, fig. 2, 1791, Brazil; after *Coro coro* Marcgrave.
Conodon antillanus Cuvier & Valenciennes, Hist. Nat. Poiss., V, 156, 1830, Jamaica.
Pristipoma coro, Poey, Fauna Puerto-Riqueña, 324, 1881; Stahl, l. c., 77 and 163, 1883.
Conodon nobilis, Jordan & Evermann, l. c., 1324, 1898.

Genus 85. BRACHYDEUTERUS Gill. The Burritos.

Body oblong; scales large, those above in series parallel with lateral line; mouth small, outer teeth in jaws somewhat enlarged; inside of jaws not red. Anal spines small or moderate, second little, if any, longer or stronger than third, and lower than soft rays; soft dorsal and anal largely covered with small scales; dorsal spines 12; soft dorsal comparatively long, of 15 or 16 rays; otherwise essentially as in *Pomadasis*, fins smaller and more scaly. Only one of the four American species is known from Porto Rico.

149. Brachydeuterus corvinæformis (Steindachner).

Head 3 to 3.25; depth 3.25; eye 3.75 to 4 in head; snout 2.2 to 3; D. XII, 15; A. III, 7; scales 6–51–10. Upper profile regularly arched from snout to tail, highest point at origin of dorsal; lower profile nearly straight to base of anal; preorbital slightly less than eye; maxillary not reaching eye, 3.33 to 3.4 in head; anterior nostril oval, twice size of posterior; preopercle finely toothed, about 20 teeth on upper limb, increasing slightly in size toward angle; dorsal notched almost to base, fourth spine longest, 2.12 to 2.5 in head; longest soft ray (second) equal to or slightly less than longest spine; pectoral pointed, 1.25 to 1.4 in head; ventral broad, margin nearly straight, inner ray 1.25 in second, which is 2 in head; the first ray branched once, slightly filamentous, the other rays much branched; second and third anal spines about equal, 3 to 3.75 in head, relatively larger in smaller specimens, second stouter; first soft ray 2.5 in head; margin of anal slightly concave, last ray shorter than second spine; upper lobe of caudal longer, the difference more noticeable in smaller specimens, 1.33 to 1.5 in head, middle rays 1.75 in upper; pectoral scaly at base only, other fins, except spinous dorsal, more or less completely scaled, a narrow sheath of scales on sides of dorsal and anal, supplementary scales slightly developed in axil of ventrals; least depth of caudal peduncle 1.5 to 1.6 in length from below end of dorsal, its length being equal to middle caudal rays; lateral line and rows of scales above it concentric with back, scales below lateral line in horizontal rows.

Color in alcohol: Dark olive above, lower sides more or less silvery, larger specimens much the lighter, a dark line along each row of scales below lateral line, these rather indistinct in larger specimens; scales above lateral line with dark centers, these not forming distinct lines; a diffuse dark blotch on scapular region, very faint in the larger specimens; pectoral colorless, other fins punctate, margins very dark. There is considerable variation in the ground-color, larger specimens being distinctly silvery, some of the smaller heavily washed with olive and having scapular blotch more developed.

Our specimens differ from Steindachner's description in having a rather shorter maxillary, not reaching eye, narrower preorbital, and a blotch on scapular region. They are, however, probably not specifically distinct.

The range of this species is from the West Indies to Brazil; apparently common about Porto Rico, specimens being in the collection from Palo Seco, Aguadilla, Mayaguez, Arroyo, Hucares, and Isabel Segunda. It reaches a length of about a foot, and is a good pan-fish.

Hæmulon corvinæforme Steindachner, Ichth. Notizen, VII, 16, 1868, Santos, Brazil.
Brachydeuterus corvinæformis, Jordan & Evermann, l. c., 1326, 1898.

Genus 86. POMADASIS Lacépède. The Burros.

Body oblong, somewhat compressed, back not much elevated; mouth rather small, terminal, low, lips thin; maxillary usually not extending to opposite eye, its tip not reaching posterior edge of broad preorbital; premaxillary protractile; teeth on jaws only, in villiform bands, subequal, or outer series in upper jaw more or less enlarged; no red on jaws; a central groove behind symphysis of lower jaw; cheek and opercles scaly; the preopercle rather distinctly serrate, serræ below not turned forward; suprascapular serrate; scales large, those above lateral line in series parallel with it; no small scales at base of the others; soft dorsal and anal fins naked, or with very few scales at the base; dorsal fin emarginate, spines strong, 12 or 13 in number, soft rays 11 to 14; anal fin of 7 or 8 soft rays, short, with second spine always very strong; gillrakers feeble, few in number; caudal lunate, forked.

This genus is composed of small shore fishes, some of its representatives being found in most tropical seas; several enter fresh waters, and perhaps belong to the brackish-water fauna. Numerous species are found on the west coast of Africa and about the Cape Verde Islands, but so far as known none enters European waters. Only three of the eight American species are known from Porto Rico.

a. Dorsal spines xii; preorbital broad.
b. Scales small, 65 in a longitudinal series; body elongate; maxillary extending a little beyond front of eye; anal spines strong, second three-fourths depth of body. Color, nearly plain; silvery below .... *productus*, 150
aa. Dorsal spines xiii; preorbital narrow.
c. Body moderately elongate, depth 2.66 to 3 in length .... *crocro*, 151
cc. Body very long and low, compressed, back little elevated, depth about 3.6 in length................ *ramosus*, 152

150. **Pomadasis productus** (Poey).

Head 4 in total length with caudal; depth 4.33; eye 4; D. xii, 12; A. iii, 7; scales 65. Body elongate, maxillary extending a little beyond front of eye; anal spines strong, second three-fourths depth of body. Color, nearly plain; silvery below. (Poey.)

Apparently closely allied to *P. bayanus* and differing from *P. ramosus*, if the descriptions can be trusted, in having but 12 dorsal spines. Recorded from Cuba and Porto Rico by Poey; not seen by us.

Pristipoma productum Poey, Memorias, II, 186, 1860, Havana; Poey, Fauna Puerto-Riqueña, 324, 1881.
Pomadasis productus, Jordan & Evermann, l. c., 1332, 1898.

151. **Pomadasis crocro** (Cuvier & Valenciennes). "*Viejo.*"

Head 3; depth 2.66 to 3.5; eye 3.5 to 5; D. xiii, 11 or 12; A. iii, 6 or 7; scales 6–54–16; preorbital 4 to 8; snout 2.8 to 3.66; maxillary 3 to 4; pectoral 1.16 to 1.5; fourth dorsal spine 1.8 to 2.25; second anal spine 1.5 to 2; soft dorsal 2 in spinous. Body elongate, compressed, back elevated, high at nape, anterior profile rather irregular, varying with age; a more or less distinct frontal depression above eye in old examples; mouth small, maxillary barely extending to anterior edge of orbit; lower jaw included; preopercle coarsely serrate, teeth wide apart; teeth small, outer scarcely enlarged; scales rather large, those above lateral line in parallel series; dorsal fin moderately notched; second anal spine very strong and long, reaching past tips of all rays; pectoral short, caudal slightly lunate.

Color in life: Grayish, with about 12 narrow interrupted stripes formed by pale-silvery quadrate spots, one on middle of each scale, plainest on middle of side; under parts white, washed with rusty; opercle brassy; top of head rusty; spinous dorsal darkish; ventrals and pectoral dusky; iris lemon-yellow; mouth scarlet within, pale flesh-color anteriorly.

West Indies, from Cuba to Brazil; generally common on sandy coasts. A specimen, 7.5 inches long, obtained in San Juan market, where others were seen. A good food-fish, though of small size.

Pristipoma crocro Cuvier & Valenciennes, Hist. Nat. Poiss., V, 264, 1830, Martinique.
Pristipoma cultriferum Poey, Memorias, II, 185, 1860, Havana; Poey, Fauna Puerto-Riqueña, 324, 1881; Stahl, l. c., 77 and 163, 1883.
Pomadasis crocro, Jordan & Evermann, l. c., 1333, 1898.

152. **Pomadasis ramosus** (Poey). "*Ronco Blanco.*"

Head 3.15; depth 3.7; eye 4; snout 3.1; maxillary 2.7; mandible 2.25; interorbital 4.4; preorbital 6.6; D. xiii, 12; A. iii, 7; pectoral 1.7; ventral 1.7; caudal 1.4; scales 6–57–13. Body long and low, back somewhat compressed and a little elevated, anterior profile nearly straight; head pointed, mouth not large, maxillary reaching past front of orbit, lower jaw included; teeth in villiform bands, outer row in upper jaw slightly enlarged; preopercle and suprascapular scale strongly serrate; dorsal fin continuous, well notched, spines very strong; second anal spine very greatly enlarged, as long as longest rays; bases of soft dorsal and anal with a sheath of small scales, that of soft dorsal low; caudal lunate; lateral line nearly straight save under soft dorsal.

Color in life: Silvery, bluish on back, slightly brassy on side, white below; pectoral pale-yellow; ventral pale; anal and soft dorsal darker, membrane of spinous dorsal dark-edged; caudal dark with black edge.

Found in the West Indies, south to Brazil. Two specimens, about 10 inches long, one from San Juan market, the other from the Rio Loiza near Caguas, more than 25 miles from the coast and in fresh water. Five young examples, each 2 to 3 inches long, were taken in the seine at Aguadilla. This species is said by the native fishermen to utter the grunting noise characteristic of the family. Though not large, it is nevertheless a good food-fish and is highly valued.

Pristipoma ramosum Poey, Memorias, II, 186, 1860, Cojimar River, Havana, Cuba.
Pomadasis ramosus, Jordan & Evermann, l. c., 1334, 1898.

Family XLVI. SPARIDÆ. The Porgies.

Body oblong, or more or less elevated, covered with rather large, adherent scales, which are never truly ctenoid. Lateral line well developed, concurrent with back, not extending on caudal fin. Head large, crests on skull usually largely developed. No suborbital stay. Mouth small, terminal, low, and horizontal. Premaxillaries little protractile; the maxillary short, peculiar in form and in articulation, without supplemental bone, for most of its length slipping under edge of the preorbital, which forms a more or less distinct sheath; preorbital usually broad; teeth strong, those in front of jaws conical, incisor-like or molar; lateral teeth of jaws always blunt and molar; no teeth on vomer or palatines; posterior nostril largest, usually more or less oblong or slit-like; lower pharyngeals separate; gills 4, a large slit behind the fourth; pseudobranchiæ large; gillrakers moderate; gill-membranes separate, free from the isthmus; preopercle entire or serrulate; opercle without spines; sides of head usually scaly; dorsal fin single, continuous, or deeply notched, spines usually strong, depressible in a groove; spines heteracanthous, that is, alternating, the one stronger on the right side, the other on the left, 10 to 13 in number; anal fin rather short, similar to soft dorsal, and with 3 spines; ventral fins thoracic, rays I, 5, with a more or less distinct scale-like appendage at base; caudal fin usually more or less concave behind; air-bladder present, usually simple; pyloric cæca few; vertebræ usually 10 + 14 = 24; intestinal canal short.

Carnivorous shore fishes of the tropical seas, especially abundant in the Mediterranean, the Red Sea, and the West Indies.

a. Teeth in front of jaws conical or incisor-like, not molar; dorsal fin continuous; posterior nostril oblong; preopercle entire.

b. Second interhæmal bone enlarged, hollowed anteriorly, or pen-shaped, receiving the posterior end of air-bladder in its anterior groove; posterior nostril slit-like.

c. Front teeth narrow, compressed, forming lanceolate incisors; first spine-bearing interneural with an antrorse spine; temporal crest obsolete; lateral crest nowhere coalescing with supraoccipital crest; interorbital area flattish, with two low ridges; a small foramen in each of these above front of pupil; interorbital area much contracted anteriorly; a strongly projecting prefrontal process, which makes an acute angle with supraorbital.

d. Frontal bones partly porous and gibbous; antrorse dorsal spine attached directly to interneural; third dorsal spine very long, longer than the head .... OTRYNTER

dd. Frontal bones not gibbous nor porous; antrorse dorsal spine attached to interneural by a long process or spur; third dorsal spine about half head .... STENOTOMUS

cc. Front teeth conical or canine-like; first spine-bearing interneural without antrorse spine; temporal crest very thin and high, joining lateral crest which forms part of margin of orbit above middle of eye, both crests coalescing with supraoccipital in cavernous anterior part of interorbital area; interorbital area somewhat contracted anteriorly; prefrontal process very strong, making an obtuse angle with supraorbital, this process forming a conspicuous knob above the long posterior nostril .... CALAMUS, 87

bb. Second interhæmal spine normal, not "pen-shaped."

e. Front teeth conic, not compressed; no incisors; occipital crest coalescent with temporal crests; no antrorse spine on first interneural; dorsal spines usually 11 to 13.

f. Anterior teeth in both jaws strong, decidedly canine-like; body more or less deep and compressed .... PAGRUS

ee. Front teeth incisor-like; no canines.

g. Incisors broad; molars in 2 to 4 series in each jaw.

h. First spine-bearing interneural with an antrorse spine in front.

i. Supraoccipital and temporal crests nowhere coalescent, interorbital area not swollen; frontal bone in interorbital area thin, concave in transverse section; temporal crest low, separated from supraoccipital crest by a flattish area which extends forward on each side of supraoccipital crest and to groove of premaxillary spines. Incisors conspicuously notched .... LAGODON

ii. Supraoccipital and temporal crests coalescent anteriorly, both disappearing in the gibbous interorbital area; frontal bone between eyes transversely convex and more or less honeycombed; temporal crest separated from occipital crest by an excavated area bounded anteriorly by lateral crest, which merges into supraoccipital above eye. Incisors entire or with a shallow notch .... ARCHOSARGUS, 88

hh. First spine-bearing interneural without antrorse spine above; skull essentially as in *Archosargus*, frontal bone more cavernous .... DIPLODUS

Genus 87. CALAMUS Swainson. Pez de Plumas.

Body oblong, compressed, back elevated; head large, preorbital deep; mouth small, teeth strong, those in front conical or pointed, those on sides molar; preopercle entire, posterior nostril slit-like; dorsal fin rather low, not much notched, soft rays low, not scaly; caudal well forked; anal spines small; pectoral rather long. Second interhæmal bone enlarged, hollowed anteriorly, or pen-shaped, receiving posterior end of air-bladder in its anterior groove; first spine-bearing interneural without antrorse spine; temporal crest very thin and high, joining lateral crest which forms part of margin of orbit above middle of eye, both crests coalescing with supraoccipital in cavernous anterior part of interorbital area; interorbital area somewhat contracted anteriorly; prefrontal process very strong, making an obtuse angle with supraorbital, this process forming a conspicuous knob above the long posterior nostril.

Shore fishes, remarkably distinguished by the structure of the interhæmal. This genus contains numerous very closely related species, all American and all valued as food-fishes.

CALAMUS:

a. Scales comparatively small, 8 or 9–54 to 58–18 or 19; about 6 vertical rows of scales on base of preopercle, with about 12 scales entering into formation of lower margin; species of large size, with preorbital deep, pectoral fin long, and outer teeth strong.

b. Body very deep, back elevated, depth in adult half length to base of caudal; outer teeth about $\frac{10-12}{12-10}$ in number, outer one on each side in one or both jaws sometimes enlarged, canine-like; sometimes directed forwards, especially in adult.

c. Preorbital with reticulations of bluish ground-color around bronze spots; canines of upper jaw usually vertical, but sometimes, especially in old examples, directed more or less horizontally forward; body deeper than in other species, depth 1.9 to 2.25 in length; anterior profile not very steep, slightly curved; depth of preorbital less than half head .... *calamus*, 153

cc. Preorbital region, snout, cheek, and opercles brassy, crossed by horizontal, wavy, non-reticulating lines of violet-blue, brightest on preorbital and snout; a sky-blue blotch behind eye over opercle, extending a short distance on body; outer canines of upper jaw directed horizontally forward, except in very young, these teeth longer than in *C. calamus;* anterior profile nearly straight and very steep to nape, then strongly convex.

d. Eye about 4 in head; side with dark crossbands; blue lines on preorbital reticulating; iris dark .... *proridens*

dd. Eye larger, about 3.5; side with bluish longitudinal lines; blue lines on preorbital not reticulating; iris yellow. *kendalli*, 154

bb. Body more elongate, depth 2.17 to 2.75 in length.

e. Upper jaw with a strong antrorse canine on each side, as in *C. proridens;* preorbital with blue, wavy stripes; preorbital deep; dorsal high; pectoral reaching front of anal; cheek with blue flexuous lines, anastomosing and forming rivulations; spinous dorsal edged with black .... *pennatula*

ee. Upper jaw without antrorse canines, anterior teeth strong, $\frac{4-6}{6-8}$, one on each side of upper jaw more or less enlarged; body rather oblong, snout long and pointed, anterior profile forming a nearly even curve to front of dorsal. Color dull-brassy with little blue; a faint blue stripe below eye; preorbital dull-coppery, usually plain, sometimes faintly veined with bluish. Young, as in other species, with dark crossbands .... *bajonado*, 155

GRAMMATEUS:

aa. Scales comparatively large, 6 or 7–45 to 52–13 or 14; about 5 vertical rows of scales on base of preopercle, with about 9 scales entering into the formation of lower margin; no antrorse canines.

f. Pectoral fin long, about 3 in body.

g. Scales of moderate size, 50 to 52 in the lateral line. Body very deep, the back elevated, depth about 2.2 to base of caudal; longest dorsal spine about half head.

h. Canines moderate, about $\frac{8-10}{10}$; preorbital broad, its least width about 2.25 in head. Body moderately compressed, rather elongate, back only moderately elevated, anterior profile convex to eye, thence straight to point of snout. Color smutty-silvery, with dark crossbands; blotches on fins; no black axillary spot .... *leucosteus*

gg. Scales large, about 46 (45 to 48) in lateral line; body rather elongate, depth about 2.25 in body; longest dorsal spine about 2.5 in head.

i. Canine small, about $\frac{10}{12}$; eye large, 3 in head; dorsal spines XI; preorbital narrow, about equal to eye. Dorsal outline forming a comparatively regular arch, back being elevated, anterior profile steep and nearly straight. Color, plumbeous-gray, with a blue spot on each scale, preorbital with blue streaks; a blue streak below eye; a blue point in axil .... *macrops*

ff. Pectoral fin short, about 3.5 in body.

j. Dorsal outline forming a comparatively regular arch, anterior profile from snout to base of spinous dorsal evenly convex; back elevated, depth in adult about 2.17 in length; canines subequal, $\frac{8}{10}$; preorbital not very deep; pectoral shortish. Color, dull silvery, with pearly spots on scales of back; preorbital bluish, plain, or with pearly markings, without blue stripes; a faint pale streak below eye; axil with a small inky-black spot; crossbars on body usually persistent.. *penna*

jj. Dorsal outline not forming a regular arch, anterior profile straight from base of spinous dorsal to nape, where a rather sharp angle is formed, thence straightish above eye, snout convex; body rather elongate, depth about 2.5 in length.

k. Preorbital deep, nearly twice diameter of eye; canine teeth $\frac{8}{10}$. Body oblong, back little elevated, anterior profile unevenly curved, very convex before eye. Color, olivaceous, with dark bars or spots, centers of many scales pearly; 6 yellowish spots along lateral line; preorbital brownish, usually with dashes of golden-yellow; membrane of opercle orange; fins mostly barred or spotted.................................... *arctifrons*, 156

kk. Preorbital not deep, pectoral short, 1.2 in head; dorsal fin low, longest spine about 3 in head; canines $\frac{8}{8}$, moderate, equal. Body little elevated, the anterior profile rather strongly convex, curve continuous from snout to middle of dorsal. Color, olivaceous, with darker crossbands; preorbital plain; a dark axillary spot; a blue subocular band.. *medius*

153. Calamus calamus (Cuvier & Valenciennes). "*Pluma*"; *Saucer-eye Porgy.*

Head 3.1; depth 2.2; eye 3.4; snout 1.6; maxillary 2.5; interorbital 3.3; preorbital 2.1; D. XII, 12; A. III, 10; pectoral 0.9; ventral 1.5; caudal 1.2; scales 8–54–16; teeth in the outer row in front of each jaw enlarged but without distinct canines. Anterior profile forms a regular curve from tip of snout to dorsal, save in a small specimen, which has a distinct depression above eye.

Color in spirits: Not markedly different from that of other examples of the species of *Calamus* in the collection.

Five examples, 3.5 to 8.75 inches long, collected at Arroyo, Mayaguez, and Boqueron. The range of this species is from the Florida Keys southward among the West Indies. It has been recorded from Martinique, Jamaica, Cuba, and various points in southern Florida. It attains a length of about a foot and a weight of a pound or more. Those seen in market probably do not average over half a pound in weight. It is an excellent food-fish and always commands a fair price. At Key West, and apparently in Porto Rico also, it is usually taken with hook and line and affords some sport as a game fish.

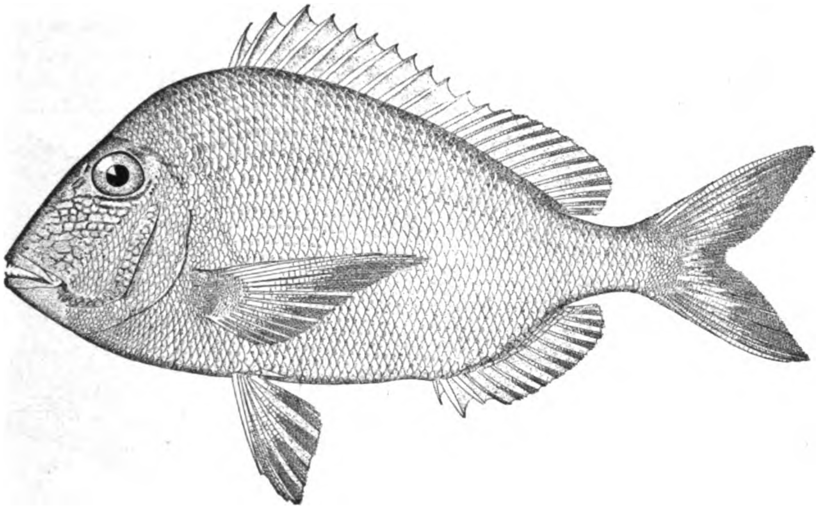

FIG. 58.—*Calamus calamus.*

Pagellus calamus Cuvier & Valenciennes, Hist. Nat. Poiss., VI, 206, pl. 152, 1830, Martinique and Santo Domingo.
Calamus megacephalus Swainson, Nat. Hist. Fish., II, 222, 1839, Martinique and Santo Domingo; after Cuvier & Valenciennes.
Pagellus orbitarius Poey, Memorias, II, 201, 1860, Havana.
Calamus macrops Jordan & Gilbert, Synopsis, 927, 1883, Garden Key, Florida.
Calamus calamus, Jordan & Evermann, l. c., 1349, 1898.

154. Calamus kendalli Evermann & Marsh. "*Pluma.*"

Head 3.1; depth 2.1; eye 3.5; snout 1.5; maxillary 2.4; interorbital 3.5; preorbital 2.1; D. XII, 12; A. III, 10; pectoral 1; ventral 1.8; caudal 1.3; scales 7–53–16. Body deep, back strongly elevated, more so than in *C. bajonado*, but less than in *C. calamus* or *C. proridens*, anterior profile a nearly regular curve, lacking the abrupt nuchal elevation of those species; eye large, larger than in *C. proridens;* 7 or 8 rows of scales on cheek; teeth about as in *C. proridens;* molars in two or more rows on sides, those of inner row much the largest, those in front becoming more numerous and merging into cardiform teeth, the most anterior of which in each jaw are somewhat enlarged; in front of upper jaw are 2 much enlarged antrorse canines, curved slightly upward; highest dorsal spine 2.7 in head, second anal spine 4.6.

Color in spirits: Silvery, sides with bluish longitudinal lines following rows of scales, plainest above; a pale-blue line bordering orbit below; some blue lines on preorbital, not evidently reticulated and not as numerous as in *C. proridens;* iris yellow; otherwise as in *C. proridens*, to which this species is very close.

Type, No. 49362, U. S. N. M., 10.5 inches long, collected at Mayaguez, January 20, 1899; 2 others, each 8.5 inches long, from Mayaguez and Arroyo, are more slender (depth 2.3 and 2.45 in length), but not differing in any other character.

This species is probably not common about Porto Rico, as it was obtained only at Mayaguez and Arroyo. It was not noticed in any of the markets. Like all other members of the genus, however, it is doubtless a good food-fish, and probably reaches a length of a foot or more.

Calamus kendalli Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 353, Mayaguez, Porto Rico.

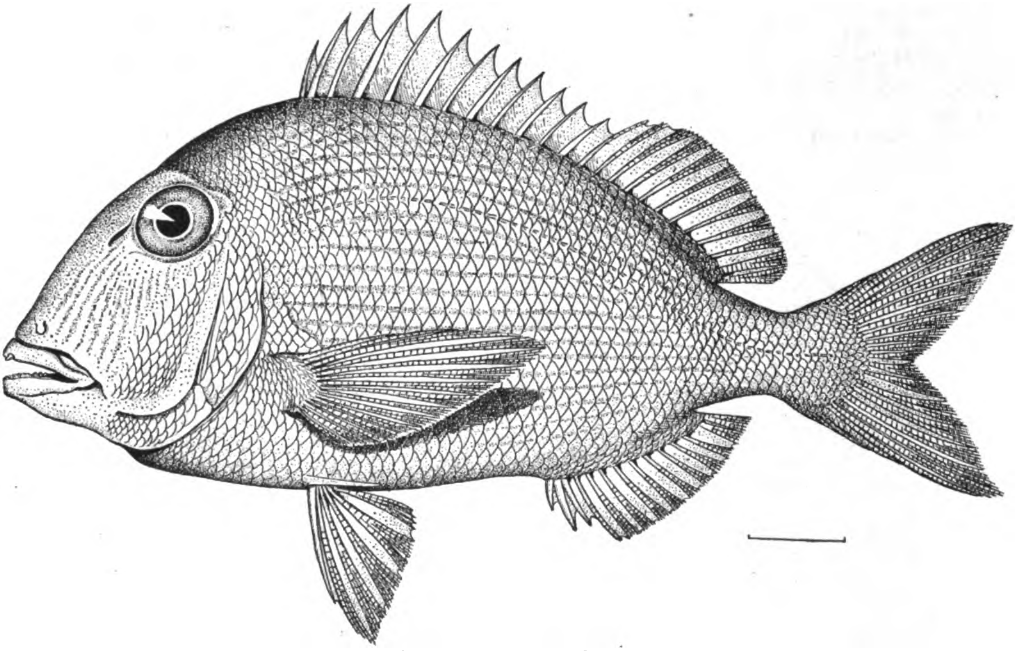

FIG. 59.—*Calamus kendalli.*

155. **Calamus bajonado** (Bloch & Schneider). "*Pluma*"; *Jolt-head Porgy; Bajonado.*

(PLATE 25.)

Head 3.2; depth 2.3; eye 3.3; snout 1.7; maxillary 2.5; interorbital 3.3; preorbital 2.1; D. xii, 12; A. iii, 10; pectoral 0.9; ventral 1.4; caudal 1.1; scales 7–54–17. Body less elevated than in *C. calamus* or *C. proridens*, snout more pointed, anterior profile not so steep, rising in a regular curve to front of dorsal; anterior teeth enlarged, becoming very strong in adult, one on each side on front of upper jaw usually enlarged and canine-like, but not antrorse.

Color in spirits: Dull olive, with blue luster; faint longitudinal lines of blue; a blue line bordering orbit below, and one above nostril, extending on forehead; obscure irregular blue lines on preorbital; caudal faintly and obscurely barred.

This porgy is found throughout the West Indies and north to southern Florida. It is the most abundant species of the genus and reaches the largest size. We have examined specimens 2 feet long and weighing 8 or 10 pounds. The average weight of those usually caught does not exceed 5 or 6 pounds. It frequents smooth rock bottom upon which it is said to spawn in July and August. It is one of the most common species about Porto Rico, as elsewhere, and is said to be found at all seasons. Because of its large size it is more important as a food-fish than any of its congeners, though its flesh is somewhat coarse. It is taken in the hook-and-line fishery and also in various fish-traps.

Our collections contain 5 examples, each 6 to 8 inches long, obtained at Puerto Real and Arroyo. Others were seen in the possession of the fishermen at those places.

Bajonado Parra, Dif. Piezas, Hist. Nat. Cuba, 13, lam. 8, 1787, Havana.
Sparus bajonado Bloch & Schneider, Syst. Ichth., 284, 1801, Havana; after Parra.
Pagellus caninus Poey, Memorias, II, 199, 1860, Havana.
Calamus plumatula Guichenot, Rev. Pagels, 119, Martinique.
Calamus bajonado, Poey, Fauna Puerto-Riqueña, 328, 1881; Stahl, l. c., 78 and 164, 1883; Jordan & Evermann, l. c., 1352, 1898.

156. **Calamus arctifrons** Goode & Bean. *Grass Porgy; Shad Porgy.*

Head 3.3; depth 2.3; eye 3.4; snout 1.9; maxillary 2.4; interorbital 3.5; preorbital 2.8; D. XII, 12; A. III, 10; pectoral 1; ventral 1.4; caudal 1.1; scales 5–47–12. Back not greatly elevated, anterior profile not steep, a slight angle in front of eye; about 5 rows of scales on cheek; 8 to 10 teeth in front of each jaw about equally enlarged and canine-like.

Color in spirits: Olivaceous, bluish above the trunk, with 6 or 7 obscure dark vertical bars, with scattering dark spots between them; similar dark spots on opercle and cheek; snout and top of head dark; a broad dark bar from eye straight downward across cheek; pectoral pale, ventrals mostly dark, color plainest inside; vertical fins with dark shades.

The grass porgy has hitherto been known only from various places on the Florida coast from Pensacola and Biscayne Bay south to Key West, and has not until now been reported from the West Indies. The only example seen by us in Porto Rico is 7 inches long, and was seined at San Antonio Bridge. This is probably the smallest species of the genus, rarely exceeding a foot in length, but is a good food-fish wherever found in sufficient numbers. It is usually taken with haul seines.

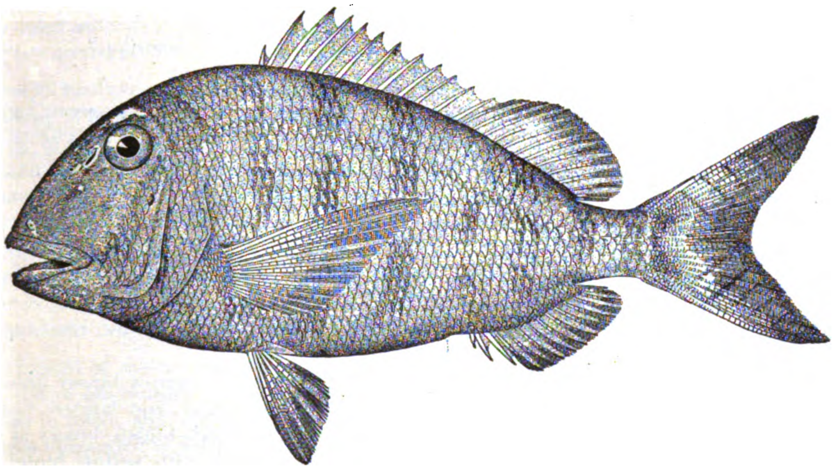

FIG. 60.—*Calamus arctifrons.*

While the other porgies are usually found on hard bottom, the grass porgy frequents the more shallow water where there is an abundance of grass or other aquatic vegetation. The limited area of this sort of bottom about Porto Rico doubtless accounts for the scarcity of this species.

Calamus arctifrons Goode & Bean, Proc. U. S. N. M. 1882, 425, Pensacola; Jordan & Evermann, l. c., 1355, 1898.

Genus 88. **ARCHOSARGUS** Gill. **Sheepsheads.**

Body robust, short and deep, compressed, covered with large scales. Head deep, mouth moderate, jaws with broad incisors in front and coarse molars on sides; incisors entire or with a shallow notch; posterior nostril slit-like; opercle entire. Dorsal and anal spines strong, soft parts of fin short and rounded; a procumbent spine before dorsal; caudal forked. Gillrakers small. Supraoccipital and temporal crests coalescent anteriorly, both disappearing in the gibbous interorbital area; frontal bone between eyes transversely convex and more or less honeycombed; temporal crest separated from occipital crest by an excavated area, bounded anteriorly by lateral crest, which merges into supraoccipital above eye.

This genus, like *Lagodon*, *Stenotomus*, and *Otrynter*, which show the same character of the procumbent dorsal spine, is confined to American waters. There are two color types in the genus, one group being made up of species with broad black crossbands, the other of species with golden streaks and inconspicuous crossbands, resembling the species of *Lagodon*. The common sheepshead (*A. probatocephalus*) is the most important member of this genus, but is not yet known from any point in the West Indies.

SALEMA:

a. Occipital crest rather thin, its honeycomb structure not exposed. Species with streaks of steel-blue and golden, dark crossbands narrow, disappearing with age, about one-third the interspaces; a black humeral spot.

b. Dorsal spines 13; incisors $\frac{3}{4}$ on each side, side of back with 8 or 9 golden streaks, which are narrower than the metallic-blue interspaces.

c. Scales 9–48–15; pectoral fin not quite reaching second anal spine; body rather deep and compressed. Incisors $\frac{3}{4}$ on each side, entire, or with a shallow notch. Fifth dorsal spine highest, 2 to 2.5 in head; second anal spine strong, recurved, 2.5 in head. Olivaceous, silvery below, upper parts with golden longitudinal stripes alternating with bluish interspaces; humeral spot larger than eye.. *unimaculatus*, 157

bb. Dorsal spines 12; incisors $\frac{3}{3}$ on each side. Profile with a slight depression above eye; second anal spine much longer than third. Color, grayish, belly white; 8 golden longitudinal bands; a black shoulder-spot.... *tridens*

ARCHOSARGUS:

aa. Occipital crest broad, its honeycomb structure plainly exposed at upper margin; dorsal spines 12; species without blue or golden markings, but with about seven broad black crossbands crossing body; no distinct shoulder-spot. Body much compressed; dorsal outline strongly arched; ventral outline almost straight. Profile straight and steep anteriorly. Incisors $\frac{3}{4}$, entire or slightly emarginate, serrate in young; molars in 3 series above, in 2 below, those of inner series larger, those behind incisors very small. Highest dorsal spine 1.33 in head; second anal spine about twice in head, much longer than third.

d. Incisors broad, their breadth about half their length. Scales 8–48–15.................................. *probatocephalus*

dd. Incisors narrower, their breadth 2.5 in their length. Scales 7–44–14 .... *aries*

157. **Archosargus unimaculatus** (Bloch). "*Chopa Amarilla.*"

(PLATE 26.)

Head 3.4; depth 2.15; eye 4; snout 2.3; maxillary 3; mandible 3.1; interorbital 3; preorbital 4.1; D. XIII, 10 to 12; A. III, 10 or 11; pectoral 6; ventral 1.3; caudal 1; scales 8 or 9–45 to 50–14 to 16. Body ovate, deep, strongly compressed, anterior profile steep and convex; mouth small, maxillary not reaching front of eye; jaws equal, armed with strong, broad incisors, their edges sometimes notched, 3 on each side in upper jaw, 4 on each side in lower; 3 rows of molars of various sizes above, 2 rows below; scales moderate, regular and cycloid, an enlarged scapular scale; dorsal fin continuous, spines strong and sharp, graduated, middle ones highest, 2.5 in head, soft rays low, last longest, 3.6 in head, base of soft fin with a low sheath of small scales; second anal spine strongest, somewhat recurved, 2.5 in head, soft rays short and weak, with basal sheath; pectoral very long, slender, reaching front of anal; caudal well forked, lobes subequal.

Color in life: Pale bluish-silvery, bluish above, side with 9 to 12 narrow brassy lines, 5 above lateral line, somewhat irregular behind, those below broader, more regular, and fainter; head bluish, with brassy bars behind eye; under parts white, throat rusty; dorsal pale-bluish, brassy at base, tips of spines darker; pectoral pale-greenish, washed with rusty, its base with yellow blotch; ventral chiefly orange, inner ray white, tips of other rays white and violet; anal dirty-orange; caudal rusty, washed with olive, middle rays black at tip. In spirits there is a diffuse black shoulder-spot, usually smaller than eye, under lateral line several rows of scales back of its anterior end, faint or invisible in life; the young have 6 or 7 diffuse vertical bars, not observed in life.

Found among the Florida Keys and in the West Indies south to Rio Janeiro, occasionally as far north as South Carolina; recorded from Charleston, Key West, Cuba, Jamaica, and Brazil. It is an abundant and important food-fish in Porto Rico. Our collection contains specimens 4 to 9 inches long, from San Juan, Puerto Real, Guanica, Ponce, and Hucares. In the market at San Juan it was noted as one of the most common species. Though not reaching a large size, it is an excellent pan-fish.

Salema, Marcgrave, Hist. Brasil., 153, 1648, Brazil.
Bream, Browne, Jamaica, 446, No. 1, 1756, Jamaica.
Perca unimaculata Bloch, Ichthyologia, pl. 308, 1792, Brazil; on a figure by Prince Maurice.
Sparus saline Lacépède, Hist. Nat. Poiss., IV, 136, 1803, Brazil; based on *P. unimaculata* of Bloch.
Sargus humeri-maculatus Quoy & Gaimard, Voyage Freycinet, Zool., 297, 1825, Rio Janeiro.
Sargus flavolineatus Cuvier & Valenciennes, Hist. Nat. Poiss., VI, 60, 1830, Cuba.
Cynædus brama Gronow, Cat. Fishes, ed. Gray, 56, 1854, South Carolina.
Sargus caribæus Poey, Memorias, II, 197, 1860, Cuba; Fauna Puerto-Riqueña, 328, 1881.
Archosargus unimaculatus, Jordan & Evermann, l. c., 1359, 1898.

Family XLVII. GERRIDÆ. The Mojarras.

Body oblong or elevated, compressed, covered with large, smooth scales; lateral line continuous, concurrent with back; mouth moderate, extremely protractile, descending when protruded, spines of premaxillary extending to above eye, closing a deep groove in top of head; maxillary without supplemental bone, not slipping under very narrow preorbital, its surface silvery, like rest of head; base of mandible scaly, a slit between it and preorbital to permit its free motion; both jaws with slender, villiform teeth; no incisors, canines, nor molars; no teeth on vomer or palatines; preopercle entire or serrate; sides of head scaly; nostrils double, round; pseudobranchiæ concealed; gillrakers short, broad; gill-membranes separate, free from isthmus; dorsal fin single, continuous or deeply notched, spinous and soft portions about equally developed, with a scaly sheath along base; dorsal spines usually 9 or 10; anal usually with 3 spines; soft portion of fin similar to soft dorsal but shorter; ventral fins thoracic, I, 5, rather close together, slightly behind pectorals; branchiostegals 6; lower pharyngeal bones close together, often appearing to be united, teeth blunt; air-bladder present; pyloric cæca rudimentary; vertebræ 10 + 14 = 24.

The *Gerridæ* comprise 6 or 8 genera and about 40 species. Four American genera are now recognized, and each is represented in Porto Rican waters by one or more species. They are carnivorous fishes, of moderate or small size, inhabiting the tropical seas, differing considerably in form and in development of spines; the intergradations are, however, very perfect, so that but for the osteological peculiarities of certain species all might be placed in one genus. Oviparous. The larger species of this family are used as food, though they do not seem to be highly esteemed anywhere. In Indian River, Florida, they are rarely used, but about Porto Rico they are in better demand.

a. Dorsal fin continuous, deeply notched.

b. Second interhæmal spine singularly developed, as a hollow cylinder, comparatively short and much expanded, posterior end of air-bladder entering its cavity; preopercle and preorbital entire; anal spines 3, second not much enlarged .... EUCINOSTOMUS, 89

bb. Second interhæmal spine normally developed, not hollow, air-bladder not entering it.

c. Second interhæmal spine very short, bluntish; anal spines 2, both small; preopercle and preorbital entire .... ULÆMA, 90

cc. Second interhæmal spine long, spear-shaped; anal spines 2 or 3, second enlarged.

d. Preopercle entire; second anal spine moderate .... XYSTÆMA, 91

dd. Preopercle serrate; second anal spine much enlarged .... GERRES, 92

Genus 89. EUCINOSTOMUS Baird & Girard. Mojarritas.

Interhæmal of second anal spine greatly modified, expanded into a hollow cylinder, into which posterior end of air-bladder enters. Preopercle and preorbital entire; body comparatively elongate, subelliptical in form; anal spines 3; second anal spine and fourth dorsal spine not greatly enlarged.

Species numerous, in warm seas, remarkable for the peculiar structure of the second interhæmal, which is formed somewhat as in *Calamus*, but much more modified than in that genus.

a. Premaxillary groove wholly naked, linear or semioval, sometimes constricted at base, but never scaled. anal rays III, 7.

b. Eye very large, its diameter much greater than length of snout, 2.66 in length of head. Exposed portion of maxillary small, triangular; premaxillary groove linear .... *dowi*

bb. Eye moderate, usually more than 3 in head, its diameter about equal to length of snout Exposed portion of maxillary triangular in front, oblong behind.

c. Body elongate, back little elevated; greatest depth 3.25 to 3.5 in length .... *pseudogula*, 158

cc. Body more compressed, deeper, back more elevated; greatest depth 2.66 in length.

d. Snout blunt; eye large, scarcely 3 in head; second anal spine large, 2.66 to 3.3 in head. premaxillary groove linear .... *harengulus*, 159

aa. Premaxillary groove scaled in front, scales leaving a naked pit behind Depth 2.4 in length; head 3 to 3.2 in length of body. Second anal spine about 3.5 in head .... *gula*, 160

158. Eucinostomus pseudogula Poey. *Mojarra.*

Head 3.2; depth 3.3; eye 3; snout 3.25; maxillary 3.3; mandible 2; interorbital 3.6; scales 5–49–9; D. IX, 10; A. III, 7. Body compressed, very slender, back very little elevated, the curve a gentle, regular one from nape to caudal peduncle; mouth moderate, nearly horizontal, maxillary reaching anterior edge of pupil, exposed portion triangular; preorbital and preopercle entire, eye large; premaxillary groove rather narrow and without scales; snout rather long and pointed. Fins moderate; dorsal spines all slender, second not enlarged, 1.66 in head; second anal spine scarcely enlarged, slightly shorter than third, 3.5 in head, the base of fin 2 in head; caudal widely forked; pectoral rather long, scarcely reaching vent, 1.2 in head; ventrals short, 2.2 in head.

Color in life: Bright silvery, with bluish and purplish reflections; back somewhat mottled with dark; fins all pale except tip of spinous dorsal, which is black; axil of pectoral dusky; snout blackish.

Usual length, 4 or 5 inches. Known from the Bermudas and from Cuba to Brazil. Not common in Porto Rico, where four specimens were obtained, all from Mayaguez.

Eucinostomus pseudogula Poey, Enumeratio, 53, pl. 1, 1875, Havana; Jordan & Evermann, l. c., 1368, 1898.
Gerres jonesi Günther, Ann. Mag. Nat. Hist., III, 1879, 150 and 389, Bermudas.

159. **Eucinostomus harengulus** Goode & Bean. *Mojarra.*

Head 3; depth 2.7; eye 3.2; snout 3; maxillary 2.8; mandible 1.8; interorbital 4; scales 5-45-10; D. IX, 10; A. III, 8. Body compressed, slender, back not much elevated; snout rather long and pointed; mouth horizontal, moderate, maxillary reaching anterior edge of pupil, its exposed portion triangular; preorbital and preopercle entire; premaxillary groove narrow, naked; eye rather large. Fins moderate; second dorsal spine slender, weak, 1.8 in head, shorter than the third; second anal spine short and weak, 3.2 in head, a little shorter than the third; caudal moderately forked, pectoral long and pointed, not quite reaching anal, 1.1 in head; ventrals short, not reaching vent, 1.9 in head.

Color in life: Silvery-white, the back with pale steel-blue iridescence; faint, shining, silvery longitudinal stripes along rows of scales; fins all pale except tips of dorsal spines, which are black.

E. harengulus is very close to *E. californiensis* and may not be really distinct. The principal difference we discover between our specimens and specimens of *E. californiensis* from the Pacific coast is that the second anal spine is somewhat larger in *E. harengulus.* Length 4 to 8 inches. It is found on the Atlantic coast of tropical America from Florida to Bahia; apparently the most abundant species of the family in Porto Rico, as is shown by numerous specimens from San Antonio Bridge and Palo Seco near San Juan, Mayaguez, Boqueron, Fajardo, Isabel Segunda, San Geronimo, and Culebra.

Eucinostomus harengulus Goode & Bean, Proc. U. S. N. M. 1879, 132, West Florida; Jordan & Evermann, l. c., 1368, 1898.

160. **Eucinostomus gula** (Cuvier & Valenciennes). *Mojarra.*

Head 3.2; depth 2.5; eye 3; snout 3.2; maxillary 3; mandible 2; interorbital 3; scales 4-45-9; D. IX, 10; A. III, 8. Body compressed, rather short, back somewhat elevated; profile straight from tip of snout to occiput, thence arched to origin of dorsal; mouth rather small, horizontal, maxillary reaching anterior edge of pupil, exposed portion narrowly triangular; eye moderate; preorbital and preopercle entire; premaxillary groove scaled except a central, nearly circular pit. Fins moderate; dorsal spines all weak and slender, second and third subequal, 1.75 in head; second anal spine slightly stouter and shorter than third, 3 in head; caudal widely forked, lobes equal to head; pectoral long, reaching past vent, 1 in head; ventrals short, 1.75 in head.

Color, silvery-white, darker on back; fins all pale, front of spinous dorsal dark at tip.

Carolinas to Brazil, the young often taken at Woods Hole, Massachusetts. Common about Porto Rico, specimens having been obtained at San Antonio Bridge, Ensenada del Boqueron, Fajardo, Culebra, and San Geronimo. Length 4 to 5 inches.

Gerres gula Cuvier & Valenciennes, Hist. Nat. Poiss., VI, 464, 1830, Martinique.
Eucinostomus argenteus Baird & Girard, Ninth Smith. Report 1855, 345, Beesley Point, N. J.
Eucinostomus gulula Poey, Enumeratio, 54, pl. 2, 1875, Havana.
Diapterus homonymus Goode & Bean, Proc. U. S. N. M. 1879, 340, Clearwater Harbor, Florida.
Eucinostomus gula, Jordan & Evermann, l. c., 1370, 1898.

Genus 90. **ULÆMA** Jordan & Evermann.

This genus is close to *Eucinostomus*, from which it differs in the form of the second interhæmal, which is short, bluntish, and not hollowed out. The single known species is slender in form, with weak spines, the anal fin having but 2.

161. **Ulæma lefroyi** (Goode).

Head 3.2; depth 3.1; eye 3; snout 3.1; maxillary 3.1; mandible 2; interorbital 3.5; D. ix, 10; A. ii, 8; scales 5–46–10. Body long and slender, dorsal profile only slightly elevated; snout long and pointed; mouth moderate, maxillary reaching only to anterior border of eye, its exposed portion short and triangular; interorbital broad; premaxillary groove long, narrow, and naked; preorbital and preopercle entire; eye large. Fins small; dorsal spines all slender and weak, second slightly shorter than third, 1.9 in head; longest dorsal rays about 3.1 in head; second anal spine small and rather short, 4 in head; caudal fin long, lobes about equal to head; pectoral slender, 1.25 in head; ventrals short, reaching only halfway to anal, 2.1 in head.

Color, silvery, darker above, with bluish iridescence, white below; fine dusky punctulations everywhere, thickest on back; dorsal, anal, and caudal dusky, other fins pale; axil dusky; snout dusky.

Found in the West Indies, on sandy shores; known from the Bermudas, Cuba, Porto Rico, Key West, and Cedar Keys. Length 4 to 6 inches. A specimen, 5 inches long, was obtained at Culebra Island, February 9.

Diapterus lefroyi Goode, Amer. Journ. Sci. Arts 1874, 123, Bermudas.
Eucinostomus productus Poey, Enumeratio, 55, 1875, Havana.
Ulæma lefroyi, Jordan & Evermann, l. c., 1371, 1898.

Genus 91. **XYSTÆMA** Jordan & Evermann. Mojarras Blancas; Muniamas.

This genus differs from *Gerres* in having the preopercle entire. The body is compressed, but not greatly elevated, and the second anal and fourth dorsal spines are less enlarged than in *Gerres*. The second interhæmal is long and spear-shaped, not hollow and not receiving air-bladder, its structure as in *Gerres*. One species, widely distributed.

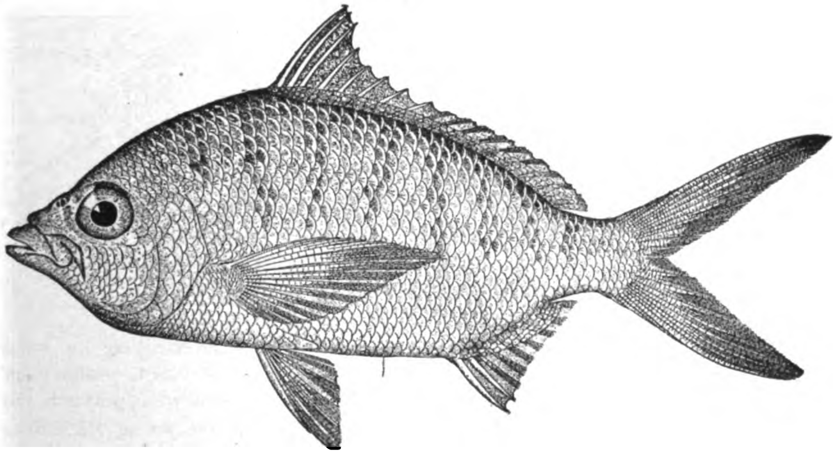

FIG. 61.—*Xystæma cinereum.*

162. **Xystæma cinereum** (Walbaum). *Mojarra; "Muniama."*

Head 3.2; depth 2.6; eye 3.4; snout 3; maxillary 2.6; mandible 2; interorbital 3.25; scales 6–45–11; D. ix, 10; A. iii, 7. Body compressed, elongate, dorsal profile moderately and regularly elevated, interorbital region slightly depressed; mouth moderate, maxillary extending to vertical of anterior edge of pupil, its exposed portion triangular in form and twice as long as wide, its length 5 in head; preorbital and preopercle entire; maxillary groove broadly ovate and without scales; gillrakers weak, 7 below angle; distance from tip of snout to origin of dorsal fin, 2.4 in body; second dorsal spine longest, 1.6 in head, not much longer than the others, all being weak and flexible; general outline of upper margin of dorsal fin falcate; second and third anal spines subequal, second not much enlarged, 2.6 in head; pectoral long and pointed, its length slightly greater than head; ventrals short, 2 in head; caudal deeply forked, lobes equal, 0. 7 in head. Scales moderately firm, a sheath at dorsal and anal fins; caudal densely covered with minute scales.

Color in life: Light bluish-white above, silvery below, with about 6 faint, vertical, bluish bars.

Found on both coasts of tropical America, and in the West Indies, north to southern Florida and Lower California; generally common in waters of moderate depth; entering rivers. Length a foot or more. A good fish, of considerable importance, reaching a larger size than most species of the family. Common about Porto Rico, where we obtained specimens from San Juan, San Antonio Bridge, Ensenada del Boqueron, and Isabel Segunda. Common in the San Juan market.

Turdus cinereus peltatus (the Shad), Catesby, Nat. Hist. Carolinas, etc., 1731, Bahamas.
Mugil cinereus Walbaum, Artedi Piscium, 228, 1792, Bahamas; after Catesby.
Gerres aprion Cuvier, Règne Animal, ed. 2, vol. 2, 104, 1829, Bahamas; based on Catesby.
Gerres zebra Muller & Troschel, in Schomburgk, Hist. Barbados, 668, 1848, Barbados.
Gerres squamipinnis Günther, Cat. Fishes, I, 349, 1859, Jamaica.
Eucinostomus aprion, Poey, Fauna Puerto-Riqueña, 328, 1881; Stahl, l. c., 77 and 163, 1883.
Xystæma cinereum, Jordan & Evermann, l. c., 1372, 1898.

Genus 92. GERRES Cuvier. Mojarras.

Second interhæmal long and spear-shaped, not excavated and not receiving end of air-bladder; preopercle serrate; body elevated and more or less rhomboid in form; third or fourth dorsal spine and second anal spine more or less elevated. Species numerous.

a. Preorbital entire; no distinct dark streaks along rows of scales.
MOHARRA:
b. Anal spines 2 only, soft rays 9; second anal spine 1.75; premaxillary groove broad, scaleless; body deep. *rhombeus*, 163
DIAPTERUS:
bb. Anal spines 3, soft rays 8.
c. Premaxillary groove broad, oval, and covered with scales (these sometimes deciduous in poorly preserved specimens). Anal III, 8; second dorsal spine 1.25 in head; second anal spine 1.6 in head; teeth rather long and slender. *olisthostomus*, 164
GERRES:
aa. Preorbital serrate; a distinct dark streak along each row of scales on back and sides; body rhomboidal, with angular outlines; spines very strong; anal rays III, 8 or 9.
d. Spines moderate, second dorsal spine two-thirds to three-fourths length of head.
e. Pectoral as long as head, not reaching front of anal, 3 to 3.33 in body; scales 38; the longest dorsal spine 1.4 in head .... *brasilianus*, 165
ee. Pectoral very long, one-sixth longer than head, 2.5 to 2.75 in body; the second dorsal spine longest, 1.5 in head; scales 35.......... *embryx*
dd. Spines very high, second dorsal spine equaling head or longer; second anal spine about equal to length of head; lateral stripes very distinct, about 12 in number; depth of the body 2.17 in length; pectoral very long, 2.66 in body; scales 37 .... *plumieri*, 166

163. Gerres rhombeus Cuvier & Valenciennes. *Mojarra.*

Head 2.8; depth 2; eye 4; snout 3; maxillary 2.4; mandible 1.8; interorbital 3.4; scales 6–38–10; D. IX, 10; A. II, 9. Body much compressed, rhomboidal, back much elevated; profile evenly convex from dorsal to supraorbital, where there is a slight depression; snout somewhat pointed; mouth large, maxillary reaching vertical of posterior border of pupil, exposed portion oblong, its width about 3 in its length, which is 3.4 in head; preorbital and preopercle entire; gillrakers short and weak, 18 below angle; premaxillary groove broadly oval and without scales. Distance from tip of snout to origin of dorsal 2 in length; second and third dorsal spines longest, second strongest, 1.6 in head; dorsal rays short; second anal spine very strong, 1.9 in head; pectoral long, 1.1 in head, reaching origin of anal; ventrals rather long, reaching past vent, 1.6 in the head; caudal well forked, the lobes subequal, 1.1 in the head.

Color in life: Silvery-white with bluish reflections, paler below; snout dusky; no dark lines along rows of scales; margin of dorsal fin black; other fins pale, ventrals and anal somewhat dusky.

Found in the West Indies and along the Atlantic coast of tropical America; generally common. Numerous specimens from San Antonio Bridge, Mayaguez, and Palo Seco. Length 10 inches or less.

Gerres rhombeus Cuvier & Valenciennes, Hist. Nat. Poiss., VI, 459, 1830, Martinique; Jordan & Evermann, l. c., 1374, 1898.
Moharra rhombea?, Poey, Fauna Puerto-Riqueña, 327, 1881; Stahl, l. c., 77 and 163, 1883.

164. **Gerres olisthostomus** Goode & Bean. *Mojarra; Irish Pompano; Mutton-fish.*

Head 3; depth 2.4; eye 3.4; snout 3.4; maxillary 2.6; mandible 1.9; interorbital 3.2; scales 6–39–11; D. ix, 10; A. iii, 8. Body compressed, rather long, rhomboid, more slender than in *G. brasilianus* dorsal outline in a double curve from tip of snout to origin of dorsal, strongly convex from nape to dorsal fin; snout conical, bluntish; mouth little oblique, large, maxillary reaching anterior edge of orbit; exposed portion of maxillary oblong, length 2.75 times its width; eye moderate; preorbital entire; preopercle weakly serrate; premaxillary groove broad, oval, covered with small, deciduous scales, a naked, linear, median depression. Fins moderate; first dorsal spine very short, the second long and moderately strong, about 2 in head, others gradually shorter; second anal spine strong, 1.6 in head, slightly shorter than third; caudal deeply forked, lobes longer than head; pectoral as long as head; ventrals shorter, 1.4 in head; least depth of caudal peduncle 1.8 in head.

Color, silvery-olivaceous; scales with faint silvery streaks but no dark ones; fins mostly pale or yellowish, ventrals somewhat dusky.

Found in the West Indies, north to southern Florida, south to Brazil. Length a foot or less. Apparently not common in Porto Rico, as the collection contains but one specimen, obtained in the San Juan market. This is 8.5 inches long, and differs somewhat from Florida examples, the second dorsal spine being shorter and the body more slender.

Gerres olisthostoma Goode & Bean, Proc. U. S. N. M. 1882, 423, Indian River, Florida.
Gerres olisthostomus, Jordan & Evermann, l. c., 1376, 1898.

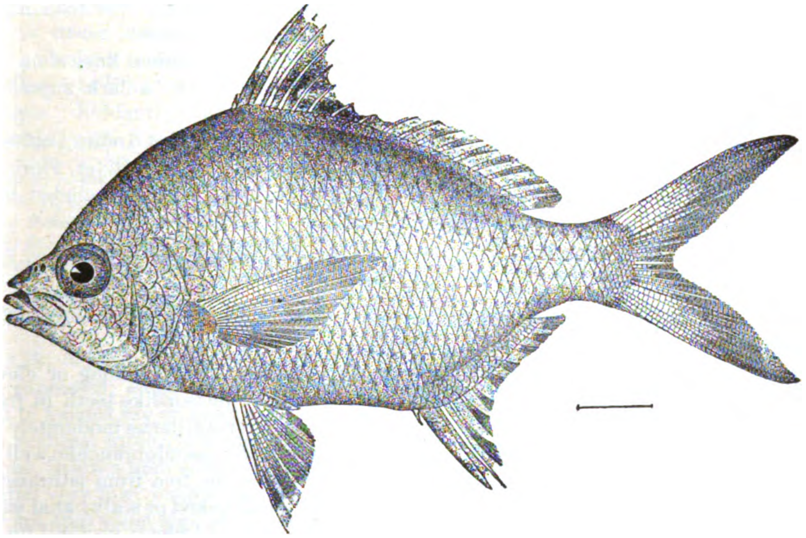

FIG. 62.—*Gerres olisthostomus.*

165. **Gerres brasilianus** Cuvier & Valenciennes. *Mojarra.*

Head 3.4; depth 2.3; eye 3.4; snout 3.25; maxillary 2.75; mandible 2; interorbital 3.3; scales 6–36–17; D. ix, 10; A. iii, 8. Body compressed, rhomboidal, back very much elevated; profile nearly straight from tip of snout to origin of dorsal fin, slightly concave above eyes; snout conical, bluntish, less acute than in *G. lineatus;* mouth horizontal, rather large, maxillary reaching middle of pupil, its exposed portion oblong, about 2.75 times as long as wide; preorbital and preopercle serrate; eye rather large; premaxillary groove very broad, narrowed posteriorly, without scales. First dorsal spine very short, second very long and strong, 1.2 in head; third slightly shorter but much weaker; remaining dorsal spines short; dorsal rays short, about 2 in head; second anal spine very long and strong, 1.2 in head; third spine slender and slightly longer than second; caudal widely forked, middle rays about 3.5 in outer; pectoral long, 0.9 in head, reaching past vent; ventrals long, 1.15 in head; least depth of caudal peduncle 2.5 in head. Length a foot or less.

Color in life: Pale-silvery, with about six bronze or blackish stripes above lateral line, upper two ceasing at origin of dorsal, and about nine similar but fainter longitudinal stripes below lateral line, upper two of which unite at anterior end; fins all dark except pectoral, which is pale; dorsal fin black-edged; anterior edge of second dorsal spine black; axil dusky.

The range of this species extends from Cuba to Bahia. It is generally common, but our collection contains only two specimens, one from the San Juan market, the other from Puerto Real, 10 and 9 inches long, respectively.

Gerres brasilianus Cuvier & Valenciennes, Hist. Nat. Poiss., VI, 458, 1830, Brazil; Poey, Fauna Puerto-Riqueña, 327, 1881; Jordan & Evermann, l.c., 1378, 1898.

166. **Gerres plumieri** Cuvier & Valenciennes. *Mojarra.*

Head 3; depth 2.16; eye rather large, 3 in head; snout 4 in head; scales 5–37–11; D. IX, 10; A. III, 8. Body compressed, rhomboidal in form, back very much elevated. Mouth rather large, maxillary extending slightly beyond vertical from anterior margin of pupil, its length 2.8 in head; exposed portion of maxillary oblong, its width 2.5 in length, which is 4.75 in length of head; preorbital and preopercle serrate; premaxillary groove broad and entirely free from scales; gillrakers small, weak, 13 below the angle; distance from tip of snout to dorsal fin equal to greatest depth of fish; upper margin of dorsal fin much concave; second dorsal spine very strong and long, its length equaling length of head; second anal spine stronger and slightly shorter than second dorsal spine, its tip reaching to vertical from base of caudal rays; third spine shorter and much weaker than second; pectoral fins reaching beyond front of anal, their length 2.66 in length of body; ventral fins reaching past vent, almost to front of anal, their length 3.4 in length of body. Length 10 inches.

Color, bluish-silvery above, silvery below; very distinct dark longitudinal lines along each row of scales; dorsal, caudal, and anal fins dusky; margin of dorsal fin black; a dark supraorbital spot; pectoral and ventral fins pale.

Found on the Atlantic coast of tropical America and among the West Indies; rather common; known from Havana, Porto Rico, Santo Domingo, Jamaica, Martinique, Indian River, Florida, Pernambuco, Bahia, Aspinwall, and Guatemala. Not seen by us in Porto Rico, but included here on the authority of Cuvier & Valenciennes and of Poey.

Gerres plumieri Cuvier & Valenciennes, Hist. Nat. Poiss., VI, 452, 1830, Antilles, Porto Rico; Poey, Fauna Puerto-Riqueña, 327, 1881; Jordan & Evermann, l. c., 1379, 1898.

Family XLVIII. KYPHOSIDÆ. The Rudder-fishes.

Herbivorous fishes, with incisor teeth only in front of jaws. Body oblong or elevated, with moderate or small scales, ctenoid or not. Mouth moderate, with incisor-like teeth in front of each jaw; no molars; teeth on vomer and palatines present or absent; premaxillaries moderately protractile; preorbital rather narrow, sheathing maxillary. Gillrakers moderate; pseudobranchiæ well developed; opercles entire. Gills 4, a slit behind fourth; gill-membranes separate, free from isthmus; dorsal fin continuous or divided, with 10 to 15 rather strong spines, soft dorsal naked or scaly; anal with 3 spines; ventrals thoracic, rays I, 5, an accessory scale at base; caudal lunate or forked; pectoral fin with all its rays branched. Intestinal canal elongate, with few or many pyloric cæca. Air-bladder usually with 2 posterior horns. Vertebræ in ordinary or slightly increased number, 24 to 28. Post-temporal of normal percoid form, the stout forks not adnate to cranium.

Shore fishes, feeding largely on green or olive algæ; chiefly of the Mediterranean Sea and the Pacific Ocean; most of them valued as food. Genera 20, species about 70.

Genus 93. KYPHOSUS Lacépède. Chopas.

Body elongate-ovate, regularly elliptical, moderately compressed; head short, with blunt snout; eye large; mouth small, horizontal; maxillary barely reaching front of eye; each jaw with a single series of rather narrow, obtusely lanceolate incisors, implanted with compressed conspicuous roots posteriorly; behind these a narrow band of villiform teeth; fine teeth on vomer, palatines, and tongue. Branchiostegals 7; gillrakers long. Preopercle obsoletely serrate; preorbital narrow, covering but little of the maxillary. Squamation very complete, space between and about eyes being the only naked part; scales smallish, thick, ctenoid, 60 to 70 in lateral line, which is continuous; similar scales entirely covering soft parts of vertical fins and extending up on paired fins. Dorsal fin low, with about 11 spines, which are depressible in a groove of scales, fin continuous, but last spines low, so that a depression occurs between the two parts of fin, bases of spinous and soft parts about equal; soft dorsal rather low in front, not falcate, pointed behind; anal similar to soft dorsal, with 3 spines; caudal fin moderately forked; pectoral fin small, ventrals well behind them. Intestinal canal long. Pyloric cæca very numerous. Vertebræ 9 or 10+15 or 16=25.

This genus contains some 10 species, chiefly confined to the Pacific Ocean, and most of them found in the East Indies.

a. Anal fin moderately elevated in front and rather short, its rays III, 11, longest ray 1.5 to 2 in base of soft part of fin. D. XI, 11 or 12. Teeth 35 to 40 in each jaw.

b. Teeth rather narrow and subacute; maxillary short, barely reaching eye, about 3.5 in head.

c. Scales moderate, 10–65–20; A. III, 13. Coloration bright-plumbeous, with many bright-yellow streaks on a plumbeous ground. Mouth and teeth not fully described........ *incisor*, 167

cc. Scales rather large, 10–55–16; depth 2.33 in length; head 3.75. Coloration dusky-gray, with about 25 gray streaks following rows of scales, those near middle of body broadest; a silvery streak along preorbital. D. XI, 12; A. III, 11........ *sectatrix*, 168

167. **Kyphosus incisor** (Cuvier & Valenciennes). *Chopa Amarilla.*

Head 5 in total with caudal; depth 3; D. XI, 14; A. III, 13; scales 10–65, pores 20; anal a third higher than soft dorsal; caudal lunate; teeth as in *K. sectatrix;* preopercle scarcely serrate; scales of back much smaller than those of sides, as are also those of head, throat, and belly. Plumbeous, with yellow lines marking edges of scales; besides yellow streak across cheek to axil, another below eye ending on opercle; yellow streak before nostrils emphasized by black edgings; fins blue, deeper on soft part; base of pectoral with yellow scales.

Cuba (Poey) to Brazil and Canary Islands; a large species, reaching 2.5 to 3 feet in length, larger than *K. sectatrix*. Evidently distinct from *K. sectatrix*, with which it is confounded by Jordan & Fesler, its relations being with *K. analogus*. Not seen by us; reported by Dr. Stahl from Porto Rico.

? *Salcima aurata* Bowdich, Excursion Madeira, 238, 1825, Bona Vista Island; description and figure very bad. D. X, 17; A. III, 14; body with light-orange stripes.

Pimelepterus incisor Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 266, 1831, Brazil.

Pimelepterus flavolineatus, Stahl, l. c., 77 and 163, 1883.

Kyphosus incisor, Jordan & Evermann, 1886, 1898.

168. **Kyphosus sectatrix** (Linnæus). *Rudder-fish; Bermuda Chub; Chub; Chopa Blanca.*

Head 3.75; depth 2.12; D. XI, 12; A. III, 11; scales 10–55–16; vertebræ 9 + 16. Body ovate, somewhat compressed; longest dorsal spine one-fifth height of body, rather higher than soft dorsal and nearly equal to longest ray of anal; teeth 35 to 40 on each side; horizontal process of teeth not much longer than vertical; interorbital space 2.5 in head; top and sides of head finely scaled; interorbital region gibbous, below which point snout is truncate; preopercle weakly serrulate; gillrakers long; soft dorsal and anal very low; longest ray of anal 2.25 in head, longest spine 2.25; median dorsal spines highest; second anal spine highest; caudal well forked, lower lobe longer.

Color in life: Steel-gray, very slightly bluish, not much paler below; edges of each row of scales on back and sides slightly brassy, so that very faint yellowish stripes alternate with bluish ones of about equal width; a diffuse pale stripe below eye, a yellowish one above and below this; fins all dull-grayish; ventrals and anal somewhat blackish; edge of opercle slightly darker. Here described from Key West specimens.

K. sectatrix ranges from Cape Cod to the West Indies, crossing the ocean to the Canary Islands; accidental in the Mediterranean; once taken at Palermo by Prof. Pietro Doderlein. Not rare off our Atlantic coast, becoming rather common southward, especially at Key West. Long noted for its habit of following vessels, supposably for waste food thrown from them, hence called rudder-fish. It is apparently not common about Porto Rico, and was not obtained by us, but is recorded by Professor Poey and Dr. Stahl.

This fish reaches a length of 18 inches or more, though the average of those caught is much less. The average weight is 3 or 4 pounds and the maximum about 9 pounds. As a food-fish it is held in high esteem, its flesh being firm and of good flavor. At Key West it occurs in certain places in abundance and is found throughout the year. The particular bottom which it seeks is the shoals in or near the channels where the water is 4 to 20 feet deep. It is one of the best and most interesting game-fishes of our southern waters. It is remarkable for the vigor and "rush" with which it takes the hook and for the mad dashes it makes to free itself. The fight which it makes is much like that one sometimes gets from an unusually large fresh-water sunfish, but is stronger, more prolonged, and more exciting, as the fish is larger and stronger.

Chub fishing at Key West, though not known to everyone who has gone to those waters to wet a line, is really one of the surest and most satisfactory ways of enjoyment the angler can find at that place. The chub is caught by still-fishing and the usual bait is pieces of the soft parts of the large spiny lobster (*Panulirus americanus*), which is very abundant about Key West. The fish swim at various depths, but usually not far above the bottom. The water is very clear and the fact that the angler can see the fish, as it rushes frantically in one direction and then in another to free itself, adds not a little to the excitement and interest of the sport.

Perca marina sectatrix (the Rudder-fish), Catesby, Nat. Hist. Car., 138, 1731, Carolina.

Perca saltarix Linnæus, Syst. Nat., ed. X, 293, 1758 (misprint, incorrectly copied from Catesby, who called it *sectatrix*), Carolina.

Chætodon cyprinaceus (Broussonet) Gmelin, Syst. Nat., I, 1269, 1788, name only; on a specimen from the tropical Atlantic (coll. Parkinson, in voyage of Capt. Cook: described by Cuvier & Valenciennes, l. c., VIII, 263).

Pimelepterus bosquii Lacépède, Hist. Nat. Poiss., IV, 429, 1803, South Carolina.

Pimelepterus oblongior Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 264, 1831, locality unknown; depth 3 in total length: 14 longitudinal streaks.

Pimelepterus bosci var. *sicula* Doderlein, Nat. Sicil., Ann. 11, fasc. 2, 1883, Palermo.

Pimelepterus boscii, Poey, Fauna Puerto-Riqueña, 330, 1881; Stahl, l. c., 77 and 163, 1883.

Kyphosus sectatrix, Jordan & Evermann, l. c., 1387, 1898.

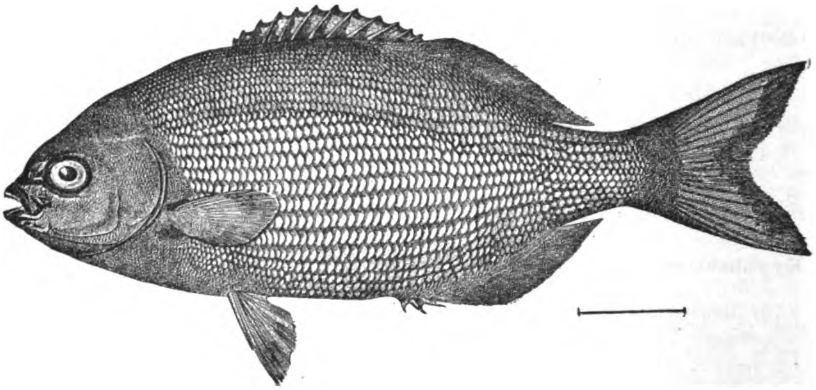

FIG. 63.—*Kyphosus sectatrix.*

Family XLIX. SCIÆNIDÆ. The Croakers.

Body compressed, more or less elongate, covered with rather thin scales, which are usually more or less ctenoid. Lateral line continuous, usually more or less concurrent with back, extending on caudal fin. Head prominent, covered with scales; bones of the skull cavernous, muciferous system highly developed, surface of skull, when the flesh is removed, very uneven. Suborbital bones without backward projecting "stay." Chin usually with pores, sometimes with barbels. Mouth small or large, the teeth in one or more series, outer of which are sometimes enlarged; canines often present. No incisor nor molar teeth; no teeth on vomer, palatines, pterygoids, nor tongue. Maxillary without supplemental bone, slipping under free edge of preorbital, which is usually broad. Premaxillaries protractile, but not very freely movable. Nostrils double. Pseudobranchiæ usually large, present in most of the genera. Gills 4, a slit behind fourth. Gillrakers present. Branchiostegals 7. Gill-membranes separate, free from isthmus. Lower pharyngeals separate or united, often enlarged, teeth conic or molar. Preopercle serrate or not. Opercle usually ending in 2 flat points. Dorsal fin deeply notched or divided into 2 fins, soft dorsal being the longer, spines depressible into a more or less perfect groove. Anal fin with 1 or 2 spines, never more than 2. Ventral fins thoracic, I, 5, below or behind pectorals. Pectoral fin normal. Caudal fin usually not forked. Ear bones very large. Pyloric cæca usually rather few. Air-bladder usually large and complicated (wanting in *Menticirrhus*).

An important family of 30 genera and about 150 species, found on sandy shores in all warm seas, a few being confined to fresh waters. None occurs in deep water and none among rocks. Many of them reach a large size, and nearly all are valued for food. All are carnivorous and some are of interest as game-fishes. Most of the species make a peculiar noise, called variously croaking, grunting, drumming, and snoring; this sound is supposed to be caused by forcing air from the air-bladder into one of the lateral horns.

OTOLITHINÆ:

I. Vertebræ 14 or 15 + 10 or 11, abdominal portion of spinal column having always more vertebræ than caudal portion, anal fin being posterior in its insertion; body more or less elongate, mouth large, lower jaw projecting; preopercle with a crenulate, membranaceous border; snout without distinct pores or slits; no barbels, preorbital narrow; gillrakers slender, moderate, or rather long; anal fin with 1 or 2 very weak spines, second closely connected with first soft ray; scales small, smoothish.

a. Anal fin long, of 15 to 21 soft rays, its length more than half that of soft dorsal; dorsal fins more or less separated; soft dorsal and anal fins closely scaled.

b. Teeth large, very unequal; tip of upper jaw with one or two strong canines; enlarged teeth or canines on sides of lower jaw; anal fin one-fourth shorter than soft dorsal, 15 to 18 soft rays; dorsal fins well separated, interspace about equal to eye; soft dorsal of 24 rays; body compressed; scales rather small, cycloid............ ISOPISTHUS

aa. Anal fin moderate, or short, of 7 to 13 soft rays, its length less than one-half that of second dorsal; dorsal fins contiguous; lateral line arched in front.

c. Canine teeth, if present, not lance-shaped, tapering from base to tip.

d. Lower jaw without canines at its tip, some of its lateral teeth sometimes enlarged; tip of upper jaw usually with canines.............................. CYNOSCION, 94

cc. Canine teeth lance-shaped, widened toward tip, then abruptly pointed; canines of front of premaxillary largest; about 2 canines on front of lower jaw on each side; outer teeth of upper jaw enlarged, somewhat lance-shaped; outer teeth of lower jaw compressed; air-bladder with 2 horn-like processes; gillrakers moderate, slender; soft dorsal and anal fin scaly.............................. SAGENICHTHYS

II. Vertebræ 9 to 12+13 to 20, typically 10+14, number in abdominal part of body being always fewer than in caudal part; dorsal fins contiguous, soft dorsal being long, much longer than anal.

e. Dorsal spines well separated, first dorsal spine attached to third or fourth interneural, not more than 2 of spine-bearing interneurals being placed between same pair of vertebræ; soft rays of dorsal fin usually 17 to 32 (37 to 40 in *Lonchiurus*, 45 to 50 in *Sciænoides*); occipital crest not greatly elevated.

SCIÆNINÆ:

f. Lower pharyngeals separate.

g. Lower jaw without barbels.

h. Caudal fin moderately scaly, its distal portion usually more or less naked, scales not numerous enough to give a thickened appearance to fin.

i. Teeth well developed, permanent in both jaws.

j. Lower pharyngeals rather narrow, their teeth conic and mostly sharp, none of them molar; outer teeth of upper jaw more or less enlarged.

k. Gillrakers comparatively long and slender; mouth more or less oblique; anal fin usually (but not always) inserted posteriorly; preorbital usually narrow, flat; edge of snout above upper jaw with pores and slits little conspicuous or obsolete.

l. Skull excessively cavernous, soft and spongy to touch, interorbital space very broad; eye very small; mouth large, oblique; preopercle with a broad membranaceous border, which is striated and fringed; scales small; spinous dorsal short and weak; anal spines weak; caudal fin pointed.

m. Pseudobranchiæ present; teeth subequal, all villiform, in narrow bands; soft dorsal long, of 30 to 35 rays; anal fin rather long, soft dorsal and anal scaly; lower jaw projecting; vertebræ 10+14; gillrakers long and slender; air-bladder with two horns.............................. NEBRIS

ll. Skull firm, not excessively cavernous, interorbital space less broad; preorbital not turgid; soft dorsal of fewer than 30 rays.

n. Scales of lateral line considerably enlarged, almost entirely concealed by smaller ones; anal fin small, inserted well forward, its first spine usually as near ventrals as caudal; caudal fin pointed, its peduncle long and slender; soft dorsal and anal scaly; scales small; preopercle without bony serræ; pseudobranchiæ small, often obsolete on one side. (Fluviatile species.).............................. PLAGIOSCION

nn. Scales of lateral line similar to the others, not concealed by smaller ones; anal fin inserted more or less posteriorly, first spine usually nearer caudal than ventrals; caudal peduncle rather short; pseudobranchiæ well developed.

o. Head not very broad, the interorbital space not notably spongy nor deeply cavernous.

p. Preopercle with its membranaceous edge entire, crenulate or ciliate, with no bony teeth; teeth in lower jaw in few series.

q. Teeth very small, equal, uniserial or very nearly so; snout very short; cleft of mouth oblique or even vertical, lower jaw projecting.............................. LARIMUS, 95

qq. Teeth larger, more or less unequal, those of lower jaw in one or two series or in bands; cleft of mouth not vertical.

r. Upper jaw with some of the teeth enlarged, forming canines; some canines in lower jaw; lower jaw projecting. ODONTOSCION, 96 *rr.* Upper jaw with narrow band of teeth, those of outer row more or less enlarged; no distinct canines...CORVULA, 97

pp. Preopercle with its bony margin armed with sharp teeth or serræ.

s. Preopercle with its lowermost spine directed abruptly downward; soft dorsal and anal fin moderately scaly; lower jaw without canines; second anal spine moderate or large .... BAIRDIELLA, 98

oo. Head very broad above, interorbital space flattish, excessively cavernous, septa reduced to thin partitions; soft dorsal and anal fin usually densely scaly; second spine of dorsal usually thickened .... STELLIFER

kk. Gillrakers comparatively short and thick, usually not longer than posterior nostril; anal fin inserted farther forward; snout above lower jaw with large pores, and with two more or less distinct slits on its edge, these sometimes obsolete; preorbital more or less broad; mouth more or less inferior.

t. Preopercle with its bony margin armed with strong persistent spines which do not disappear with age; caudal fin not lunate, middle rays longer than lower .... OPHIOSCION, 99

tt. Preopercle with its bony margin serrate in young, becoming entire with age; caudal fin truncate or lunate, middle rays not longest; slits and pores of upper jaws well developed.................................. SCIÆNOPS

ii. Teeth very small, subequal, those in lower jaw wanting or deciduous; lower pharyngeals rather broad, with paved teeth; mouth small, inferior; snout as in *Sciæna;* preopercle entire; anal fin long, with about 12 soft rays; gillrakers shortish, rather slender .... LEIOSTOMUS

gg. Lower jaw with one or more barbels, either at symphysis or on the rami; snout with slits and pores as in *Sciæna;* lower jaw included; preorbital broad; lower teeth in villiform bands; gillrakers more or less short.

u. Pseudobranchiæ well developed; pectoral fin not elongate.

vv. Lower jaw with slender barbels, usually several in number.

w. Barbels mostly in a tuft at symphysis of lower jaw; mouth very small, inferior; gillrakers minute, thickish; dorsal spines X or XI; preopercle sharply but finely serrate; preorbital turgid and cavernous, more or less translucent; caudal fin rhombic. (Fluviatile species) .... PACHYPOPS

ww. Barbels chiefly lateral, along rami of lower jaw, usually none at symphysis; lower pharyngeals narrow, with sharp teeth; preopercle with its bony margin armed with strong teeth; D. X or XI; gillrakers short, thickish. MICROPOGON, 100

vv. Lower jaw with a single thickish barbel at its tip.

x. Air-bladder large; anal spines 2; back more or less elevated; preopercle with its bony margin crenate or serrate; pectoral short, shorter than ventrals. (Free-swimming species) .... UMBRINA, 101

xx. Air-bladder none; anal spine single, weak; back not elevated; preopercle with its membranaceous edge crenulate; pectoral fins long, longer than ventrals. (Bottom fishes.) .... MENTICIRRHUS, 102

uu. Pseudobranchiæ obsolete; body long and low; caudal pointed; pectoral fin elongate; preopercle without bony serratures.

y. Mandible without barbels along inner edge. Chin with two short barbels; soft dorsal with 30 to 40 rays. LONCHIURUS

APLODINOTINÆ:

ff. Lower pharyngeals very large, completely united, covered with coarse, blunt, paved teeth; lower jaw included; snout with slits and pores, as in *Sciæna;* gillrakers rather short.

z. Lower jaw with numerous barbels along inner edge of rami; preopercle nearly entire .... POGONIAS

EQUITINÆ:

ee. Dorsal spines close together, first spine attached to first interneural, and from 5 to 12 of spine-bearing interneurals wedged in between high occipital crest and neural spine of second vertebra on the one hand, and that of third vertebra on the other; occipital crest much elevated; soft dorsal very long, of 36 to 55 rays......... EQUES, 103

Genus 94. CYNOSCION Gill. Weak-fishes.

Body elongate, little compressed, back not elevated. Head conical, rather pointed; mouth very large, terminal, not very oblique, lower jaw projecting, symphysis produced, angle at base of maxillary not prominent. Maxillary very broad. Teeth sharp, not closely set, in rather narrow bands; tip of lower jaw without canines; upper jaw with 2 long canines, 1 of which is sometimes obsolete; canines tapering from base to tip; lateral teeth of lower jaw larger than anterior. Preopercle with its membranaceous edge serrulate, bone entire. Lower pharyngeal bones separate, their teeth all pointed. Gillrakers strong, rather long. Vertebræ about 14 + 10 (instead of 10 + 14 as in Sciænoids generally). Pseudobranchiæ well developed; dorsal spines slender, fins closely contiguous; anal spines 1 or 2, very feeble, soft rays 7 to 13; second dorsal long and low, more than twice length of anal; ventrals inserted below pectorals, pubic bone long and strong; caudal fin subtruncate or lunate.

Large fishes, chiefly of the waters of America, closely related to the Old World genus *Otolithus*, from which they are distinguished by the absence of canines in the lower jaw. All of them rank high as food-fishes; the flesh is rich, but in some species tender and easily torn; hence the popular name weak-fishes. The number of species of this genus known from American waters is about 20, among which are some of our most important food-fishes, including the common squeteague (*Cynoscion regalis*), which, though not exceeding 5 or 6 pounds in weight, is said occasionally to attain a weight of 30 pounds, and the spotted squeteague (*C. maculatum*), somewhat smaller and ranging further south. In the Gulf of California occurs another species (*C. macdonaldi*), which attains the enormous size of more than 170 pounds. Only one species of this genus is at present known from Porto Rico.

a. Scales not very small, lateral line having 55 to 75 pores, number of transverse series ranging from 55 to 85, not much in excess of number of pores; head compressed, not truly conical; upper jaw with distinct canines, band of teeth in upper jaw rather narrow, lower teeth small and in few series in front, larger and uniserial on sides.

b. Soft rays of dorsal and anal more or less closely scaled; gillrakers comparatively long and slender, 9 to 12 on lower part of arch, longest at least one-half diameter of eye.

c. Soft dorsal of 20 to 23 rays.

d. Caudal fin rhombic, middle rays considerably produced.

e. Snout short, bluntish, 4.6 in head; mouth small, little oblique, canines quite small; color pale, with faint darker streaks; axil pale, pseudobranchiæ sometimes wanting. D. ix–i, 20; A. i, 8 .... *acoupa*

cc. Soft dorsal of 26 to 29 rays; caudal fin subtruncate or double truncate, middle rays but slightly produced.

f. Coloration nearly uniform silvery.

g. Caudal truncate; body slender, depth more than 4 in length; snout short; maxillary not reaching beyond eye. D. x–i, 27; A. i, 11 .... *obliquatus*

gg. Caudal weakly double-concave; body deep, depth 3.5 to 4 in length.

h. Snout long, 3.75 in head, longer than eye .... *jamaicensis*, 169

hh. Snout long, 4.5 in head, shorter than eye. D. x–i, 27 to 29, A. ii, 9 or 10 .... *nothus*

ff. Coloration brownish-silvery above, with many dark-brown spots, arranged in undulating streaks; body more or less compressed; eye moderate, 5 to 7 in head; maxillary extending to below posterior margin of eye, 2.17 in head; canines large; color brownish-silvery, with iridescent reflections and marked with many small, rather irregular, dark-brown spots, some of which form undulating lines running upward and backward; upper fins dusky, lower yellowish.

i. Snout not very sharp, about 4.25 (4 to 4.33) in head; gillrakers long and slender, usually 5 + 10 to 12 in number; membranes of soft dorsal and anal more or less closely scaly, scales readily deciduous .... *regalis*

ii. Snout very sharp, 3.75 to 3.8 in length of head; gillrakers shorter, rather slender, 4 + 8 or 9 in number; membrane of soft dorsal and anal with very few scales, these readily deciduous .... *thalassinus*

bb. Soft rays of dorsal and anal scaleless; gillrakers comparatively short and thickish, usually not longer than pupil, and but 6 to 8 on lower limb of arch.

j. Coloration not uniform, grayish and silvery, back with distinct darker spots, lines, or reticulations; caudal fin truncate or slightly double-concave.

k. Soft dorsal fin with conspicuous round black spots; back and sides covered with similar spots smaller than pupil, larger than those on fins; snout acute, much longer than eye; pectoral 2.25 in head. D. x–i, 25 to 27; A. ii, 10 .... *nebulosus*

aa. Scales comparatively small; number of pores in lateral line 70 to 90, and very much fewer than number of transverse rows, which is from 85 to 150; teeth of upper jaw in a rather broad band, 1 to 4 of them usually more or less canine-like, canines generally small and sometimes wholly disappearing with age; lateral teeth of lower jaw not much enlarged; gillrakers usually small and short.

l. Caudal fin lunate or subtruncate; scales not very small; head more or less distinctly conical, not flattened above; soft dorsal with 21 to 23 rays.

m. Soft dorsal fin with its lower portion covered with small, caducous scales. Body compressed; head compound-conic; canines small, both present; pectoral 2 in head; caudal weakly double-truncate. D. ix–i, 21 to 23; A. ii, 10 .... *leiarchus*

ll. Caudal fin rhombic or S-shaped, middle rays produced, upper lobe usually pointed; soft dorsal with 23 to 28 rays.

n. Soft dorsal entirely naked; anal with a few scales; body long and low, spindle-shaped; head depressed above; mouth large; canines present, short and thick; eye small, caudal S-shaped, middle rays longest; pectoral 1.8 in head; scales very small. D. x–i, 28; A. i, 8 .... *virescens*

nn. Soft dorsal and anal fins densely scaly throughout; teeth all small, canines moderate; scales very small; pectoral 1.75 in head; caudal S-shaped; color greenish, silvery below. D. xi–i, 23; A. ii, 9 .... *microlepidotus*

169. Cynoscion jamaicensis (Vaillant & Bocourt). "*Corvina*"; *Mongolar Drummer.*

Head 3.3; depth 4; eye 4.7; snout 3.8; maxillary 2.1; mandible 1.7; interorbital 3.6; preorbital 15.5; D. x–i, 25; A. ii, 10; pectoral 1.8; ventral 2; caudal 2.1; scales 11–76–8. Body elongate-elliptical, considerably compressed; head pointed; snout a little longer than eye; mouth large, lower jaw projecting; teeth in narrow bands, a few of the outer ones enlarged, especially on sides of lower jaw, where they are recurved and incurved; one strong recurved canine in front of upper jaw; lateral line decurved under last dorsal spines. Color in life, silvery-grayish, bluish above, whiter below; fins all pale except edge of soft dorsal, which is dark.

Known only from Jamaica and Porto Rico. Two specimens, about 11 inches long, from San Juan market, January 6, and two young ones, 5.5 and 4.5 inches, from Isabel Segunda, February 8, 1899. The dentition of the upper jaw exhibits an interesting condition. The single large canine tooth of the upper jaw is located at one side of the symphysis; on the other side is a tooth of similar appearance and nearly as large, but soft and flexible. Apparently there is structurally a pair of canines in the front of upper jaw, but only one becomes functional. Both specimens exhibit this peculiarity; in one the developed tooth is upon the right side of the symphysis, in the other on the left.

Otolithus jamaicensis Vaillant & Bocourt, Miss. Sci. au Mexique, Poissons, 156, 1874, Jamaica.
Cynoscion jamaicensis, Jordan & Evermann, l. c., 1406, 1898.

Genus 95. LARIMUS Cuvier & Valenciennes.

Body rather elongate, compressed; skull firm, not greatly cavernous; interorbital space rather narrow; preorbital flattish, not turgid; upper jaw with usual slits and pores little developed; no barbels; no canines; snout very short, mouth large, terminal, very oblique or even vertical, lower jaw projecting; teeth minute, equal, uniserial or partly biserial above; preopercle entire or nearly so, without bony teeth. Scales moderate, subequal. Pseudobranchiæ well developed. Fins essentially as in *Bairdiella*, second dorsal long, anal short, its spines moderate or small; fins not thickened by accessory scales. Gillrakers long and slender. Vertebræ 10 + 14. Silvery fishes, all American.

a. Mouth more or less oblique, not quite vertical; upper part of body with dark streaks along rows of scales; profile slightly convex, a little oblique; maxillary extending to below front of orbit, 2 in head.
b. Dorsal rays 27 to 30; mouth notably oblique.
c. Upper parts with distinct dark streaks along rows of scales.
d. Second anal spine 1.66 in head, reaching tips of soft rays; dark streaks on sides not very distinct; mouth very oblique; gill-cavity pale .... *breviceps*, 170
bb. Dorsal rays 24 to 27; mouth still less oblique, snout more convex, profile descending forward.
e. Color grayish, silvery with about 7 dark vertical crossbars; second anal spine short, 3.25 in head. Body heavy forward, much compressed, snout very short and blunt, 5.5 in head; mouth large, less oblique than in other species; tip of premaxillary on level of middle of pupil; maxillary 2 in head; gillrakers extremely elongate, as long as eye, 12 + 24; second anal spine short, one-fourth shorter than the first soft ray. D. x–i, 24 to 26; A. ii 5 or 6 .... *fasciatus*

170. **Larimus breviceps** Cuvier & Valenciennes. "*Cabezon*"; "*Corbino Cabezon.*"

Head 3.2; depth 3; eye 3.8; snout 5.1; maxillary 2.1; mandible 1.8; interorbital 4; preorbital 11; D. x–i, 27; A. ii, 6; pectoral 1.1; ventral 1.4; scales 6–50–9. Body oblong, heavy forward, back much compressed, caudal peduncle long and slender; scales thin and ctenoid; head short; mouth large, very oblique, approaching a perpendicular, maxillary reaching front of pupil or beyond, lower jaw heavy and prominent, its tip projecting; snout very short; preopercle unarmed; teeth small, in one row in each jaw; head scaled; gillrakers long and slender, 13 + 20; fins small, dorsal spines weak and flexible, soft dorsal long and low, anal very small, second spine much enlarged, reaching about to tip of longest soft rays; caudal double truncate.

Color in spirits: Pale, back dark-olivaceous; membrane of spinous dorsal dusky; caudal streaked with dusky; axil with some black. In life the fins showed the following colors: Dorsal darkish, caudal pale, yellow above and below; anal yellow next to spine, pale elsewhere; ventral yellow on outer half, other half pale; pectoral pale-lemon.

Found in the West Indies, and south to Brazil; known from Jamaica, St. Lucia, and Porto Rico. Length a foot or less. A good food-fish. Three adults, about 8.5 inches in length, from San Juan market, and five young, 3.5 to 5 inches, from Ponce and Isabel Segunda.

Larimus breviceps Cuvier & Valenciennes, Hist. Nat. Poissons, V, 146, 1830, Santo Domingo and Brazil; Jordan & Evermann, l. c., 1423, 1898.
Monosira stahli Poey, Fauna Puerto-Riqueña, 326, pl. 6, 1881, Porto Rico; Stahl, l. c., 163, 1883.
Larimus stahli, Eigenmann & Norris, Sobre alguns peixes de S. Paulo, Brazil, 361, 1900.

Genus 96. ODONTOSCION Gill.

This genus differs from *Larimus* mainly in the presence of canines, and may be described as a *Larimus* armed with canine teeth. It also approaches closely to *Bairdiella*, from which it differs in lacking the plectroid spine on the preopercle and also in the dentition, the group *Elattarchus* lying between the two, as does also the closely related group *Corvula*.

171. **Odontoscion dentex** (Cuvier & Valenciennes). *Corvina.*

Head 3; depth 3.4; eye 3.7; snout 4; maxillary 2.25; mandible 2; interorbital 4.6; preorbital 3.8 in eye; D. xi–i, 24; A. ii, 9; pectoral 1.8; caudal 1.4; scales 6–56–8. Body rather elongate, back compressed and slightly elevated; anterior profile nearly straight but not very steep; caudal peduncle long and much compressed; head moderate, snout short and blunt; eye large and placed high; teeth in a single row in each jaw, long and sharp, the pair in front of lower jaw enlarged; teeth of upper jaw similar to lower but smaller, largest in front but without distinct canines; preopercle entire; maxillary reaching middle of pupil; gillrakers about 7 + 15 (in individual 4 inches long); soft parts of vertical fins scaly; caudal truncate; dorsal spines very slender, separated from rays; second anal spine very slender, 3 in head, much longer than first, which is much reduced.

Color in spirits: Silvery-bronze, with many dark points, under parts pale; darker longitudinal streaks along rows of scales; chin dusky, axil and base of pectoral black; vertical fins dusky, with dark points, paired fins pale.

Here described from the young, of which 15 examples were taken, from 3 to 4.75 inches in length, at Mayaguez, Puerto Real and Boqueron. Length about a foot. A food-fish of some importance. Known from the West Indies, and generally common; recorded by Jordan & Rutter from Jamaica.

Corvina dentex Cuvier & Valenciennes, Hist. Nat. Poiss., V, 139, 1830, Santo Domingo.
Odontoscion dentex, Jordan & Evermann, l. c., 1425, 1898.

Genus 97. CORVULA Jordan & Eigenmann.

This genus is closely allied to *Bairdiella* in nearly all respects, but with preopercle entire and unarmed, as in *Larimus*. The species differ considerably among themselves, and they form with *Larimus* and *Odontoscion* an almost continuous series. American.

a. Body rather short and deep, depth 2.5 to 3.33 in length; distance from insertion of ventrals to first anal spine about equal to depth of body; color silvery, usually with dusky streaks along rows of scales.
b. Dorsal rays x–i, 28; posterior rays of soft dorsal higher than anterior ones; dorsal outline strongly and regularly convex and elevated. Color, silvery-white, darker above; sides and back with rather distinct dark lines along scales; spinous dorsal, tips of ventrals, and anal dusky; upper part of head brownish; lower part of head, cheek, and breast with numerous rusty dots, base of soft dorsal and anal rusty .... *sialis*
bb. Dorsal rays x to xii–i, 23 to 25; jaws equal; outer teeth above enlarged, lower teeth nearly uniserial; preopercle with flexible serræ; second anal spine, 3.66 in head; caudal fin subtruncate.
c. Maxillary reaching middle of pupil, 2.33 in head; pectoral rather long .... *subæqualis*
cc. Maxillary reaching beyond middle of pupil, 2.33 in head; pectoral very short; D. xi–i, 23; A. ii, 8 or 9; color silvery, with very distinct dark longitudinal stripes .... *sanctæ-luciæ*, 172
aa. Body rather elongate and compressed, depth 3.5 in length; distance from insertion of ventrals to first anal spine one-half greater than depth of body; coloration dusky, with conspicuous dark streaks along rows of scales. *batabana*, 173

172. Corvula sanctæ-luciæ Jordan.

Head 3.1; depth 3.2; eye 4.5; snout 4.3; maxillary 2.4; mandible 2; interorbital 4.4; preorbital 2.4 in eye; D. xi–i, 23; A. ii, 9; pectoral 1.9; ventral 1.8; caudal 1.8; scales 6–47–8. Body oblong, back compressed posteriorly and a little elevated; head rather small and blunt; snout as long or a little longer than eye; eye large, about equal to interorbital space; mouth somewhat oblique, jaws equal, maxillary reaching middle of pupil; a band of fine teeth in upper jaw, outer a little enlarged; teeth in lower jaw in one row with a few scattering ones; preopercle with a finely crenulate membranous edge; gillrakers 8 + 19, counting rudiments, longest one-half eye; scales large and strongly ctenoid, rows above lateral line anteriorly parallel with it; below last dorsal spines these rows turn upward and become horizontal again under anterior part of soft dorsal; dorsal spines slender, finely pointed but not sharp; soft dorsal and anal scaly at base; caudal truncate, scaled to near edge; second anal spine slender, shorter than first rays.

Color in spirits: Pale, darker above, with a bluish luster; each row of scales save the few lowermost with a grayish-brown stripe, these most continuous above, where they follow the upturned rows of scales; many dark punctulations everywhere; axil dark; fins not notably colored, but with many punctulations.

A species known at once by the horizontal stripes and their characteristic bend upward under the notch separating the dorsals. Hitherto known only from the type from Port Castries, St. Lucia. This description is from our largest specimen, 7.75 inches long, from Isabel Segunda; about 20 other individuals from Isabel Segunda, Ponce, Mayaguez, Hucares, and Boqueron, ranging in length from 2.5 to 6.5 inches; smaller specimens have the eye 3.5 in head.

Corvula sanctæ-luciæ Jordan, Proc. U. S. N. M. 1889, 649, Port Castries, St. Lucia; Jordan & Evermann, l. c., 1429, 1898.

173. Corvula batabana (Poey). "*Barriga Blanca.*"

Head 3.3; depth 3.2; eye 4; snout 4.2; maxillary 2.25; mandible 2; interorbital 3.9; preorbital 7.8; D. xi–i, 28; A. ii, 8; pectoral and ventral 1.7; caudal 1.6; scales 7–45–7. Body oblong, back compressed posteriorly, belly long, distance from ventrals to anal greater than depth of body; head moderate, profile nearly straight, a slight concavity above eye; mouth not small, maxillary reaching middle of eye or beyond; teeth of upper jaw in an enlarged outer row, behind which is a band of very small teeth; lower jaw with a single series similar to outer row in upper jaw; snout with a few small pores, chin with 5 larger ones; edges of scales with fine striæ, rows below lateral line bending slightly upward opposite origin of anal, most apparent in smaller individuals; lateral line curved, concurrent with outline of back, becoming straight on caudal peduncle; dorsal spines weak; soft parts of vertical fins densely scaled, a sheath of larger scales at their bases; caudal rounded, or double truncate.

Color in spirits: Body nearly everywhere lustrous grayish-brown; about 8 longitudinal stripes of darker brown following rows of scales below lateral line; above lateral line are interrupted stripes and scattered spots of same color; fins all about color of body.

Known only from Cuba and Porto Rico. Four specimens, 8 to 10 inches in length, were obtained by us at Puerto Real and Arroyo.

Johnius batabanus Poey, Memorias, II, 184, 1860, Batabano, Cuba; Poey, Fauna Puerto-Riqueña, 327, 1881; Stahl, l. c., 77 and 163, 1883.

Corvula batabana, Jordan & Evermann, l. c., 1430, 1898.

Genus 98. BAIRDIELLA Gill. Mademoiselles.

This genus is characterized by the oblique mouth, little cavernous skull, few rows of small teeth, slender gillrakers, and preopercle armed with a plectroid spine. It is certainly a very natural group, and worthy of recognition as a distinct genus, although its relationships with *Ophioscion* and especially with *Stellifer* are very close. The numerous species are all American, all small in size and silvery in coloration, and some of them are remarkable for the great size of second anal spine. In others this spine is quite small. These variations among species unquestionably closely allied show how slight is the systematic value to be attached to the size of this spine.

a. Teeth of lower jaw unequal, chiefly biserial; inner teeth more or less enlarged; preorbital narrow.
b. Second anal spine moderate, 2.33 in head, not so long as soft rays, not reaching tip of last ray when depressed. Color, silvery, punctate; fins yellow; depth 3 in length. D. x-i, 22; A. ii, 10........................... *chrysura*
bb Second anal spine very long, two-thirds length of head, reaching beyond tip of last ray; base of anal oblique, forming an angle with ventral outline.
c. Mouth not quite terminal; preorbital narrow; dorsal rays x-i, 23; dorsal spines stiff, lower, highest 2 in head; second anal spine 1.4; pectorals 1.6. Color, soiled silvery; depth 3.14................................ *ronchus*, 174

174. **Bairdiella ronchus** (Cuvier & Valenciennes). *Ronco; Ground Drummer.*

Head 3.1; depth 3.2; eye 4.6; snout 4.1; maxillary 2.5; mandible 2.1; interorbital 4.5; preorbital 9.3; D. x-i, 24; A. ii, 8; pectoral 1.6; ventral 1.5; caudal 1.5; scales 7–50–8. Body oblong and compressed, anterior profile straight and rather steep; ventral outline straight from chin to origin of anal; base of anal very oblique, forming a strong angle in ventral outline; caudal peduncle long, compressed; head small, snout rather pointed, a little longer than eye; mouth nearly horizontal, maxillary reaching past middle of eye (in individual of 4.25 inches nearly to posterior border of orbit), lower jaw included; teeth in upper jaw villiform, in a very narrow band, outside of which is a row of much larger teeth; in lower jaw a band of villiform teeth with a somewhat enlarged inner row; preopercle with strong serrations, largest at angle, lowermost being the downward-pointing plectroid spine characteristic of *Bairdiella;* dorsal spines moderately strong, sharp, fourth highest, 2 in head; first anal spine reduced, second very long and strong, reaching tips of first rays and beyond all the other rays, 1.6 in head; ventrals nearly to vent; caudal truncate.

Color in spirits: Dirty-grayish, darker above, paler below; some dark punctulations on lower part of side scattered along from snout to base of lower lobe of caudal; faint dark streaks along longitudinal and oblique rows of scales; paired fins pale; edge of soft dorsal, spinous dorsal, caudal, and part of anal dusky, with dark dots.

Found on Atlantic coast of tropical America; generally common in the West Indies and on the coast of Brazil; recorded from Jamaica, Cuba, Maracaibo, Surinam, and obtained by us at San Juan and Mayaguez, Porto Rico. Though not exceeding 8 or 10 inches in length, this is a good food-fish.

Corvina ronchus Cuvier & Valenciennes, Hist. Nat. Poiss., V, 107, 1830, Maracaibo and Surinam.

Bairdiella ronchus, Jordan & Evermann, l. c., 1436, 1898; Poey, Fauna Puerto-Riqueña, 326, 1881; Stahl, l. c., 77 and 163, 1883.

Genus 99. OPHIOSCION Gill.

This genus is composed of small species, nearly all American, allied to *Sciæna* (*Sciæna umbra* L.), but differing in the armature of the preopercle, its bony margin being at all ages armed with strong persistent serræ, the lowermost teeth not directed forward. The caudal fin in this group is never lunate; the soft dorsal and anal are scaly; teeth in bands; gillrakers rather short.

There are 7 or 8 American species of this genus, all except *O. adustus* being known only from our Pacific coast.

175. Ophioscion adustus (Agassiz).

Head 3.25; depth 3.3; eye 4.2; snout 3.2; maxillary 2.8; mandible 2.5; interorbital 3.7; preorbital 5.4; D. XI–I, 22; A. II, 7; pectoral 1.5; ventral 1.5; caudal 1.4; scales 6–56–10. Body compressed, the dorsal outline of trunk trenchant, ventral outline of body nearly straight, the dorsal outline evenly arched; caudal peduncle long and thin; top of head not trenchant, evenly convex; snout rather long and blunt, scarcely projecting beyond the small inferior mouth; several pores and clefts in fleshy tip of snout; chin with five pores, the middle one, at symphysis, smallest; lower jaw well included; maxillary reaching anterior edge of pupil or middle of eye; teeth in both jaws, in villiform bands, the outer row in upper jaw enlarged; top of head, cheeks, and opercles scaled; snout and under parts of head naked; eye moderate, nearer tip of snout than gill-opening; preopercular serræ rather blunt, 9 or 10 in number; dorsal fin deeply notched, the spines weak, flexible, sharp, with filamentous appendages projecting beyond their ends, the first very short, the third longest, the rest graduated to the tenth, which is shortest, the eleventh being somewhat longer, the twelfth much longer, pertaining to the soft portion of the fin, which is scaled on membrane between rays; ventrals rather long and slender, outer rays slightly filamentous, reaching about to vent; anal small but high, first spine very short, second very long and strong, 1.6 in head, longest ray about equaling second spine; caudal large, rounded, finely scaled.

Color in spirits: Everywhere brownish with a bluish iridescence, save under parts, which are pale; the brown color on lower part of side is broken up into spots, which are darker at center; faint longitudinal brown lines following rows of scales, plainest below, scarcely evident in some specimens; anal and the paired fins grayish-black; dorsal and caudal like body; one specimen has scarcely any brown color, is grayish above and white below.

Five specimens, 3 to 3.5 inches in length, from Vieques and Arroyo. These differ in certain respects from Agassiz's colored figure of *Sciæna adusta*—chiefly in the larger eye, in the shorter straight portion of lateral line, and in the length of the second anal spine, which equals the longest rays, but is only half as long in the drawing. Nevertheless, we believe that our specimens are the young of Agassiz's species. The artist was manifestly somewhat inaccurate in his reproduction, as in the number of soft dorsal rays, and certainly in the omission of the short first anal spine. Moreover, the drawing was based upon a specimen much larger than ours (10 inches). We think these considerations are sufficient to explain the differences. The description of *O. adustus* in Jordan & Evermann's Fishes of North and Middle America hardly applies to the *Sciæna adusta* of Agassiz, but is based upon a specimen from Pernambuco, which probably belongs to some other species.

Sciæna (*Corvina*) *adusta* Agassiz, Spix, Pisc. Brasil., 126, pl. 70, 1829, Montevideo.

Genus 100. MICROPOGON Cuvier & Valenciennes. Croakers.

Body moderately elongate, compressed, somewhat elevated; preopercle strongly serrate; teeth in villiform bands, outer row in upper jaw enlarged; lower jaw with a row of minute barbels on each side; gillrakers short, thickish; spinous dorsal rather short, of 10 or 11 stoutish spines; second anal spine moderate; caudal fin double-truncate; lower pharyngeals narrow, distinct, with sharp conical teeth; air-bladder with long horns. A well-marked genus, the species all American, allied to *Ophioscion* and *Sciænops*, but distinguished by the presence of barbels; species all closely related, similar in form, size, and color, and all of value as food-fishes.

a. Dorsal rays X–I, 28 to 30.
b. Scales comparatively small, about 9 in a vertical series between front of dorsal and lateral line, 12 in an oblique series; outer teeth of upper jaw evidently enlarged; dark spots on scales above lateral line not forming continuous stripes; scales 54 .... *undulatus*

bb. Scales larger, 7 in a vertical series from front of dorsal to lateral line, 9 or 10 in an oblique series; teeth of outer series in upper jaw scarcely enlarged; dark spots above lateral line forming continuous streaks nearly as wide as interspaces; short vertical bars extending across lateral line; many oblique lines above these; markings more regular, though less sharply defined, than in *M. undulatus*.

c. Second anal spine moderate, 5 in head; eye small, 6 in head; scales 54 .... *furnieri*, 176

176. **Micropogon furnieri** (Desmarest). *Verrugato; White-mouth Drummer.*

Head 3.25; depth 3.7; eye 5.35; snout 3.25; maxillary 3.2; mandible 2.7; interorbital 3.8; preorbital 4.6; D. x–i, 30; A. ii, 8; pectoral 1.4; ventral 1.9; caudal 1.6; scales 7–51–9. Body elongate, with a rather long and slender caudal peduncle; back a little elevated, profile from the eye to the dorsal nearly straight, head not large, snout rather long and blunt; mouth small, low, little oblique, lower jaw included; teeth small, in a band in each jaw; preopercle serrate with 2 enlarged spines at angle; soft dorsal and anal naked; soft dorsal low, with a 1-rowed basal sheath of scales; caudal double-truncate, its basal half scaly; base of pectoral with a few scales; dorsal spines very slender, sharp; anal very small.

Color in spirits: Silvery-white, upper half with many oblique bluish bars a little wider than interspaces, anteriorly extending across lateral line and becoming wider; a dark opercular spot.

This species is close to *M. undulatus*, and is known from Cuba to Surinam; abundant on coast of Cuba; recorded by Jordan & Rutter from Jamaica; probably not rare in Porto Rico. Our collection contains two fine specimens, 7.5 and 10.5 inches long, obtained at San Juan and Arecibo. A good food-fish, reaching the length of a foot or more.

Umbrina furnieri Desmarest, Première Décade Ichth., 22, pl. 2, fig. 3, 1822, Havana.
? *Micropogon argenteus* Cuvier & Valenciennes, Hist. Nat. Poiss., V, 218, 1830, Surinam.
? *Micropogon undulatus*, Poey, Fauna Puerto-Riqueña, 325, 1881; Stahl, l. c., 77 and 163, 1883.
Micropogon furnieri, Jordan & Evermann, l. c., 1462, 1898.

Genus 101. UMBRINA Cuvier.

Body moderately elongate; back somewhat arched. Head oblong, with snout thick and protuberant; mouth almost horizontal, of moderate size; preoperculum with its bony margin finely serrate; lower jaw with a single thickish barbel. Teeth in villiform bands, outermost in upper jaw somewhat enlarged. Anterior dorsal with about 10 spines; anal fin with 2 spines, second not very small. Caudal lunate or truncate. Gillrakers normal, but short. Air-bladder well developed.

This genus contains a considerable number of species, most of them being American. It agrees with *Sciæna* in nearly all respects, excepting the presence at the chin of a short, thick barbel. A similar barbel is found in the genus *Menticirrhus*, but notwithstanding the fact that all European writers have confounded *Menticirrhus* with *Umbrina*, the two genera are not really very closely related.

a. Dorsal rays only x–i, 25? no crossbands? .... *broussonetii*

aa. Dorsal rays x–i, 26 to 29; serræ of preopercle slender, not notably flattened.

b. Body with about 9 dark vertical crossbands, besides narrow undulating streaks along rows of scales; second anal spine 2.3 in head; pectoral 1.66 .... *coroides*, 177

177. **Umbrina coroides** Cuvier & Valenciennes.

Head 3.5; depth 3.5; eye 4.25; snout 3.4; maxillary 3; mandible 2.9; interorbital 4; preorbital 4.3; D. x–i, 26; A. ii, 6; pectoral 1.7; ventral 1.7; caudal 1.4; scales 5–48–10. Body rather elongate, back elevated, anterior profile nearly straight save for a slight convexity opposite eye; ventral outline nearly straight; caudal peduncle rather long and slender; head small, snout blunt and overhanging the small inferior mouth; teeth in villiform bands in each jaw; maxillary reaching beyond front of pupil; chin with a short barbel; snout with pores and clefts; preopercle with 5 teeth; fins small; caudal truncate, second anal spine much the longer and stronger.

Color in spirits: Light below, light-olivaceous above, a silvery luster everywhere; 9 darker crossbars ending about level of pectoral; faint longitudinal stripes of dark following rows of scales; some dark on dorsal, fins otherwise plain.

This interesting species ranges from southern Florida to the West Indies and Brazil; recorded from Indian River, Florida (as *U. broussonnetii*), and Jamaica; not uncommon in Porto Rico; our collection contains six specimens, 4 to 6 inches long, from Aguadilla, Arroyo, Hucares, and Vieques.

Umbrina coroides Cuvier & Valenciennes, Hist. Nat. Poiss., V, 187, 1830, Brazil; Jordan & Evermann, l. c., 1466, 1898.

Genus 102. MENTICIRRHUS Gill. The Whitings.

Body comparatively elongate, little compressed; head long, subconic, bluntish snout considerably projecting beyond mouth; mouth small, horizontal, both jaws with bands of villiform teeth, outer teeth in upper jaw more or less enlarged; chin with a single stoutish barbel; preopercle with its membranaceous edge serrulate; gillrakers short and tubercular or obsolete; dorsal spines high, slender, 10 or 11 in number (13 in *Cirrimens*); second dorsal long and low; caudal fin with lower angle rounded, upper sharp; anal fin with a single weak spine; no air-bladder. Lower pharyngeals separate, teeth varying from sharp to very obtuse.

This genus is one of the most strongly marked in the family. It has been confounded by all European writers with *Umbrina*, with which it has not very much in common except the presence of the barbel at the chin. All the species are American, and all bottom fishes. The low, elongate body, large pectoral, and obsolete air-bladder are all characters related to this peculiarity of habit. The species are all valued as food-fishes.

MENTICIRRHUS:

a. Dorsal spines usually 11; head not terete, depressed, with low snout.

b. Gillrakers obsolete, reduced to tubercular prominences, covered with teeth similar to those on the other gill-arches, more developed in the young; lower pharyngeals narrow; the teeth villiform or cardiform, all of them acute or conical, none with rounded heads (molar); teeth in the outer series of upper jaw more or less enlarged; scales on breast large.

c. Soft dorsal longer, its rays I, 23 to I, 25.

d. Outer teeth of upper jaw decidedly enlarged; dorsal spines not much elevated, the longest usually not reaching front of soft dorsal, 1.5 to 1.66 in head. Coloration, grayish-silvery, the dark markings not pronounced and often obsolete.

e. Dorsal rays X–I, 22 to 24; snout rather shorter and less pointed than in *M. americanus*, 3.5 in head; mouth smaller, the maxillary 3 in head. Coloration usually plain, sometimes very dark, otherwise as in *Menticirrhus americanus*.. *martinicensis*, 178

ee. Dorsal rays X–I, 24 or 25; snout longer, 3.33 in head; maxillary reaching nearly to middle of eye 2.8 to 3 in head; eye small, 2 in snout; teeth villiform, in broad bands, the outer series of the upper jaw very much enlarged, larger than in the other species; ventrals short, 1.5 in pectoral; pectoral 1.25 in head; caudal with the broad rounded lower lobe longer than the acute upper; scales all ctenoid, those of the breast larger and regularly placed. Color, grayish-silvery, with obscure darker clouds along the back and sides, these marks forming dusky bars, running obliquely forward and downward to considerably below the lateral line, these often obsolete; the bar at the nape saddle-like; lining of gill-cavity dusky; pectoral yellowish, dusky at tip; an obscure dusky streak along the lower part of side running into lower lobe of caudal ...... *americanus*

dd. Outer teeth of upper jaw less enlarged; spinous dorsal elevated, the longest spine reaching past front of soft dorsal, its length 1.5 in head; coloration strongly marked, body scarcely silvery; eye small, 2.33 in snout, 2 in interorbital area, about 7 in head; snout long, bluntish, 3.8 in head; mouth large; maxillary reaching middle of eye, 2.8 in head; pectoral 1.14 in head. Color dusky-gray above, sometimes blackish, the back and sides with distinct dark oblique crossbands running downward and forward, the anterior one at the nape extending downward, meeting the second and thus forming a V-shaped blotch on each side; a dark lateral streak bounding the pale color of the belly, most distinct posteriorly and extending on lower lobe of caudal; inside of gill-cavity scarcely dusky; pectoral dark.. *saxatilis*

UMBRULA:

bb. Gillrakers present, very short and rather slender; lower pharyngeals rather broad; some or most of teeth molar, that is, enlarged, with thickened rounded heads, the molar teeth covering at least anterior portion of bone; teeth in outer series of upper jaw scarcely larger than the others; scales on breast small............... *littoralis*

178. Menticirrhus martinicensis (Cuvier & Valenciennes). *Jewsharp Drummer.*

Head 3.3; depth 4; eye 7; snout 3.7; maxillary 3; mandible 2.8; interorbital 4.2; preorbital 5.3; D. X–I, 24; A. I, 7; pectoral 1.4; ventral 2.2; caudal 1.6; scales 6–54–12. Body quite elongate, back considerably elevated, ventral outline nearly straight; head small, conical, upper profile gently convex; mouth not large, inferior, maxillary reaching past middle of eye; outer teeth of upper jaw considerably enlarged; snout projecting beyond mouth; spinous dorsal small, spines slender and pointed, but not sharp; soft dorsal very low; anal very small; pectoral large; caudal with an emargination in upper lobe, lower lobe the longer; lateral line almost straight except at ends, parallel with outline of back.

Coloration usually plain, sometimes very dark; back and sides usually with oblique dusky bars. Our specimens are pale below, darker above, and show few definite markings; there are faint oblique dark lines following rows of scales; tip of pectoral and ventrals and edge of anal nearly black.

Known from the West Indies to Patagonia; very common on the Brazilian coast, where it replaces the closely related *M. americanus*, from which it is not well separated; recorded from Jamaica, Martinique, and Rio Janeiro, and obtained by us in the San Juan market and at Palo Seco, Porto Rico, where it is probably not rare. It is a fair food-fish.

Umbrina martinicensis Cuvier & Valenciennes, Hist. Nat. Poiss., V, 186, 1830, Martinique.
Umbrina gracilis Cuvier & Valenciennes, Hist. Nat. Poiss., V, 189, 1830, Brazil.
Umbrina arenata Cuvier & Valenciennes, Hist. Nat. Poiss., V, 190, 1830, Brazil.
Umbrina januaria Steindachner, Ichth. Beitr., V, 122, 1876, Rio Janeiro.
Menticirrhus martinicensis, Jordan & Evermann, l. c., 1473, 1898.

Genus 103. EQUES Bloch. Ribbon-fishes.

Body oblong, compressed, back much elevated anteriorly, rapidly tapering to narrow caudal peduncle; mouth small, lower jaw included; preorbital wide; snout with slits and pores well developed; teeth all villiform, in broad bands, outer scarcely enlarged; preopercle with a fringed border and no bony serræ; scales small, irregular, with smaller ones intermixed, extending on soft fins; gillrakers few, short, and slender; dorsal fin very long, of 9 to 15 close-set spines and 36 to 55 soft rays; anterior interneurals closely wedged in behind occiput; anal small, its spine small; caudal rhombic; pyloric cæca few; vertebræ 10+15=25.

This genus is one of the most remarkable in the family in respect to form as well as to the coloration of its species.

a. Dorsal rays x to xii-i, 36 to 46, first 4 to 6 of the interneurals wedged in between neurals of second and third vertebræ.
b. Profile steep, but not vertical; distance from snout to first dorsal spine about equal to depth of body.
c. Dorsal spines little elevated, not nearly as long as head; back arched; dorsal with 38 to 41 soft rays; color variously dusky or gray, with at least traces of about 7 lengthwise streaks; depth 2.6 to 2.75 in length .... *acuminatus*, 179
cc. Dorsal spines elevated, longest 2.75 in length of body; soft parts of vertical fins with white spots; body robust, back much compressed, general form much as in *Eques acuminatus*, but caudal peduncle deeper and more compressed; pectoral and ventral short and equal, 1.14 in head. Color, dark-brown, a light bar in front of eye extending around chin, a second pale bar extending around head immediately behind eyes, a third extending from in front of dorsal over base of pectoral; a light bar along base of soft dorsal; a light bar extending from behind elevated portion of spinous dorsal downward, dividing into two, the branches running straight back, upper branch to beginning of last fourth of soft dorsal, lower branch to base of caudal; 2 or 3 light, undulating longitudinal bars below these; fins all dark brown, vertical fins with many whitish stellate spots. Head 3.75 in length; depth 3. D. xi or xii-i, 46.......... *punctatus*
bb. Profile very steep. Body deepest below first dorsal spine, thence rapidly tapering to narrow caudal peduncle. Color, olivaceous, 3 dark-brown longitudinal bands along side, middle one from eye backward reaching tips of middle caudal rays. D. x-i, 37.......... *pulcher*
aa. Dorsal rays xiv or xv-i, 53; about 9 interneurals wedged in between neurals of second and third vertebræ; profile almost vertical; body highly variegated, with ribbon-like oblique bands.......... *lanceolatus*

179. Eques acuminatus (Bloch & Schneider). "*Berdugo*" or "*Bergudo.*"

Head 3.1; depth 2.8; eye 3.8; snout 4.1; maxillary 2.6; mandible 2.4; interorbital 4.2; preorbital 5.2; D. x-i, 39; A. ii, 7; pectoral 1.5; ventral 1.5; scales about 50. Body elongate, compressed posteriorly, back much elevated, ventral outline nearly straight; anterior profile straight from front of dorsal to upper part of blunt snout; mouth moderate, low, maxillary reaching middle of eye, lower jaw included; teeth in bands, outer row in upper jaw enlarged; soft fins all more or less scaly; gillrakers short, not pointed, 6 + 8.

Color in spirits: Everywhere dark brown, with pale longitudinal stripes, as follows: two from region of nape nearly confluent at middle of soft dorsal; one from a little above eye to last rays of soft dorsal; one from upper edge of eye to upper edge of caudal peduncle; two from near base of pectoral to base of caudal, the upper of these extending faintly across head to eye.

This species ranges from South Carolina to Brazil; it has been recorded from Key West, Tortugas, and Jamaica, and was obtained by us at Arroyo, Porto Rico, from which place we have two specimens, each 6 inches long. Valued as food.

Grammistes acuminatus Bloch & Schneider, Syst. Ichth., 184, 1801, no locality; after Seba.
Eques lineatus Cuvier & Valenciennes, Hist. Nat. Poiss., V, 169, 1830, Brazil.
Eques acuminatus, Jordan & Evermann, l. c., 1487, 1898.

Family L. POMACENTRIDÆ. The Demoiselles.

Body short, deep, compressed, covered with ctenoid scales of varying size; lateral line wanting posteriorly; mouth small, usually with rather strong teeth, either conic or incisor-like; vomer and palatines toothless; nostril single on each side, nearly round; preopercle with its posterior edge largely free, serrate or entire; preorbital sheathing the small maxillary; dorsal fin single, with numerous strong spines, spinous portion longer than soft, which is similar to soft anal, both fins scaly at base; anal spines 2; ventral fins thoracic, I, 5, anterior rays longest, usually filamentous; a scaly appendage at base of ventral. Lower pharyngeals fully united; branchiostegals 5 to 7; gills 3.5, slit behind last gill very small or obsolete; gillrakers rather long and slender; no labyrinthiform appendage; air-bladder and pseudobranchiæ present; pyloric cæca 2 or 3; gill-membranes free from isthmus. Vertebræ 12+14=26.

Fishes of tropical seas, similar in mode of life to the *Chætodontidæ*, feeding on small marine animals and plants in the coral reefs. Genera 15; species about 180, most of them too small to be used as food. They are very active in life and the coloration is usually brilliant, sometimes changing much with age. The family shows strong affinities with the *Labridæ* in its gill-structures and pharyngeals. In other respects it approaches the *Kyphosidæ*, while the unique character of the simple nostril is shared with the *Cichlidæ* only, from ancestors of which group the *Pomacentridæ* are probably descended.

I. Scales large, 25 to 40 in lengthwise series.

POMACENTRINÆ:

a. Teeth fixed, conical or incisor-like, covering nearly whole free edge of each jaw; carnivorous species.

b. Teeth conical, in two to four series, outer enlarged and bluntish; preopercle entire; scales large; body oblong, depth 2.5 to 1.83 in length; lateral line wanting on tail.......... CHROMIS

bb. Teeth more or less flattened or incisor-like, in one or two series.

c. Preopercle, and usually preorbital also, sharply serrate.

d. Teeth entire, strictly uniserial in each jaw; preorbital not very deep, its edge not notched; snout scaly; lower jaw naked.......... EUPOMACENTRUS, 104

cc. Preopercle and preorbital strictly entire; snout naked.

e. Teeth emarginate or Y-shaped.......... ABUDEFDUF, 105

MICROSPATHODONTINÆ:

aa. Teeth movable, incisor-like, in one row on front of each jaw; lower jaw weak, with teeth along its front only; preopercle and preorbital entire; snout scaled almost to lips; preorbital notched behind nostril; lower limb of preopercle scaled; soft dorsal and anal elevated; caudal deeply forked; soft anal rather long, of 14 or 15 rays; herbivorous species.......... MICROSPATHODON

Genus 104. EUPOMACENTRUS Bleeker. Pescados Azules.

Body ovate, deep, and compressed, profile steep, usually rounded. Head moderate, nearly as deep as long, snout scaly, lower jaw naked. Mouth quite small, terminal, jaws equal; each jaw armed with a single close-set series of compressed, immovable teeth, which are truncate at tip. Gillrakers long; preopercle more or less serrate; preorbital serrate. Scales large, strongly ctenoid, lateral line running parallel with back to near end of dorsal fin, at which point it ceases. Dorsal fin continuous, with 12 or 13 low stout spines; membrane of spinous dorsal usually not deeply incised nor lobed; soft part more or less elevated, its last rays gradually shortened; lower limb of preopercle usually more or less scaly; preorbital narrow, without deep notch; anal fin similar to soft dorsal, with 2 spines, of which the second is much the larger; soft rays 12 to 16; dorsal spines with a sheath of large scales, membranes of both dorsal and anal covered high up with small scales; caudal fin more or less forked, lobes rounded; lower pharyngeals triangular; branchiostegals 5 or 6.

Species numerous in the tropical seas, chiefly American, and extremely variable in form and color, the brilliant coloration apparently dependent on surroundings. The species are little known and the classification of those found in the West Indies is not wholly satisfactory.

a. Upper anterior profile of head arched.

b. Depth of body moderate, 1.75 to 2.25 in length, without caudal.

c. Lower posterior half of body dark, like anterior half; caudal fin mostly dusky.

d. Pectoral fin not edged with white.

e. Depth of body 1.75 in length of body (without caudal); side with faint cross-streaks.......... *adustus*

ee. Depth of body 2 to 2.25 in length.

f. Opercle without distinct dark spot; caudal not tipped with orange.

g. Anal without distinct blue spot in its posterior axil, except in young.

h. Head with few if any small accessory scales.

i. Base of pectoral without black spot or with but one.......... *fuscus*, 180

Base of pectoral with two black spots.......... *diencæus*

gg. Anal with a bluish spot at base of last ray; head and fins much spotted with blue .... *analis*, 181
ff. Opercle with a distinct dark spot above; pectoral with a dark spot; tips of all fins orange .... *otophorus*
cc. Lower posterior half of body unlike anterior part, being more or less abruptly bright-yellow; caudal fin bright-yellow; usually a blue spot at base of last ray of anal.
j. Region below lateral line with many blue spots.. *leucostictus*, 182
jj. Region below lateral line with few blue spots or none.
k. Back with two round dusky spots on each side.. *flaviventer*
bb. Depth of body about 2.75 in length; posterior half of body yellowish; fins with more or less yellowish..... *partitus*
aa. Upper anterior profile of head straight, not arched; body and fins mostly dusky, with pale spots........ *planifrons*

180. **Eupomacentrus fuscus** (Cuvier & Valenciennes). *Brown Cockeye Pilot; Maria Molle*

(PLATE 27.)

Head 3.5; depth 2.5; eye 3.4; snout 3.5; maxillary 3; D. XII, 15; A. II, 13; scales 2–28–9. Body compressed, anterior profile steep and evenly convex; dorsal and ventral outlines similar; mouth moderate, little oblique; maxillary reaching anterior border of orbit; jaws equal; teeth in a single series in each jaw, incisor-like, and closely placed; preopercle and preorbital serrate; gillrakers small, weak; scales large, ctenoid, reduced in size on head; snout, opercles, and cheek scaled; lateral line concurrent with back to below middle of soft dorsal, where it ceases. Fins rather large; longest dorsal spine about 2 in head, dorsal rays elevated, longest 1.2 in head; second anal spine 2 in head; soft anal similar to soft dorsal; caudal forked, lobes equal, about 1 in head; pectoral rather long, reaching vent; ventrals long and pointed, passing vent.

Color, dark-blue above, lighter on the sides and under parts; side of head and body with some yellowish, under parts with purple tinge; in some specimens the general color is dark-brown or nearly black; edges of scales dark, forming narrow dark vertical bands, but in most specimens these are entirely absent; dorsal and anal fins dark-bluish or olivaceous at base, the margin brighter blue; caudal dusky or pale, usually with some yellow at base; pectoral and ventrals greenish-olivaceous, no black spot at base of pectoral, no dorsal ocellus and no white spot at base of last anal ray; no bluish or whitish spots on head or body.

This species may be distinct from *E. analis*, or the latter may be simply an individual color variation from the typical form. The specimens which we refer to *E. fuscus* were obtained by us at San Juan, Aguadilla, and Ponce, and by Mr. Gray at San Geronimo.

Found in the West Indies south to Brazil and north to Key West. The least common of the three species of *Eupomacentrus* which we recognize from Porto Rico.

Pomacentrus fuscus Cuvier & Valenciennes, Hist. Nat. Poiss., V, 432, 1830, Brazil.
Pomacentrus variabilis Castelnau, Anim. Nouv. ou Rares, Poiss., 9, pl. 3, fig. 3, 1855, Bahia.
Pomacentrus atrocyaneus Poey, Memorias, II, 190, 1860, Havana.
Eupomacentrus fuscus, Jordan & Evermann, l. c., 1552, 1898.

181. **Eupomacentrus analis** (Poey).

Head 3.2 to 3.5; depth 2 to 2.4; snout 3.2 to 3.5; eye 3.2 to 3.5; maxillary 3.2 to 3.75; mandible 3.75 to 4.25; interorbital 3.25 to 3.66; preorbital 7; scales 3–28–8; D. XII, 15; A. II, 13. Body rather deep, strongly compressed, anterior profile steep and evenly convex; interorbital area strongly convex; eye usually a little greater than snout; mouth small, slightly oblique, jaws equal; teeth in single series, incisor-like and close-set; maxillary scarcely reaching vertical of anterior part of orbit; gillrakers slender, weak, and short, length less than diameter of pupil; preopercle strongly serrate; preorbital also serrate, but less distinctly so; scales large, firm, and strongly ctenoid; lateral line beginning at the upper edge of opercular opening running parallel with dorsal outline to beneath middle of base of soft dorsal, where it abruptly terminates; top of head and snout densely scaled, scales smaller than on side; opercle and preopercle scaled; chin naked; bases of dorsal and anal fins densely scaled; membranes of caudal fin covered with very small scales; dorsal spines strong and sharp, length of longest 1.8 to 2 in head; soft dorsal with its middle rays elevated, their length 1.2 to 1.4 in head; first anal spine very short, second much longer and stronger, its length 2 in head; soft anal similar to soft dorsal, its longest rays about 1.25 in head; pectoral broad, short, scarcely reaching vent, length about 1.2 in head; ventral longer, tips of outer rays passing vent, about equal to length of head; caudal forked, upper lobe the longer, usually somewhat longer than head.

Color in life very variable; back and upper part of side usually dark-blue or bluish, becoming somewhat paler on lower part of side and belly; head dark-blue; sometimes body is a dark brown, with scarcely any trace of blue; in other specimens the color is a sooty blue-black in life, under parts scarcely paler; scales on anterior part of side sometimes with a long conspicuous bronze-olive spot; head, side, and bases of vertical fins usually with small sky-blue spots, these spots frequently in life inclining to black, in alcohol becoming at first more intense blue and later fading to white; the abundance of these spots varies greatly; in larger individuals, from 3 to 4 inches in length, the spots are greatly reduced in number, sometimes almost wholly absent; more abundant in individuals 2.5 inches or under in length, sometimes profusely so. Spots on anterior part of head sometimes take the shape of narrow lines or oblong blotches; a large blue blotch at bases of upper pectoral rays, becoming black in alcohol; a large black blotch on middle of anterior dorsal rays, sometimes quite round and surrounded by a narrow blue border; a small blue spot, fading to white in alcohol, near base of last anal rays.

Seventeen specimens, varying from 3 to 3.5 inches in length, collected at Ponce, February 1, were quite uniform in coloration; they each show a few white spots, some very faintly, on side and occasionally at base of anal; none noticeable on head or fins; a white spot present in every case on last anal ray at base; a single black spot at base of upper pectoral rays; dorsal ocellus showing distinctly on only three or four specimens; caudal usually pale, yellowish on two specimens. Seven specimens, 3 to 4 inches in length, collected at Culebra Island, February 11, were each profusely covered with pale-blue or whitish spots, most abundant on head, dorsal, and base of caudal and anal; spot at base of last anal ray always present; black spot at base of pectoral sometimes obscure; dorsal ocellus usually present; caudal pale or yellowish on three or four of the specimens. Nineteen specimens, somewhat smaller, collected at Fajardo, February 17, closely resemble the Culebra specimens; some of them, however, resemble more closely specimens from Ponce in the less numerous spots; the bluish-white spot at base of last anal ray is always present, and most of the specimens show the dorsal ocellus. Twenty other specimens from Fajardo, collected on same date and of smaller size, are much more profusely spotted; the dorsal ocellus is more distinct and the caudal fin more yellowish; the lower part of sides and the belly are paler. These specimens show a near approach to *E. leucostictus*. Four specimens from Mayaguez, each about 2.5 inches long, are profusely spotted like those from Culebra and Fajardo, but the general color is much darker; white spot on anal and black one on base of pectoral present; the dorsal ocellus is fairly distinct. Eleven specimens from Puerto Real, each 3.5 inches long, resemble closely those from Ponce in having but few spots; white spot on anal and black blotch at base of pectoral both present; dorsal ocellus evident in only six of eleven specimens; caudal peduncle and fin usually yellowish. Three small specimens from Hucares are profusely covered with small blue specks and agree with those from Culebra.

In our collections from Porto Rico we have what we provisionally identify as three species of *Eupomacentrus*, namely, *E. fuscus*, *E. analis*, and *E. leucostictus;* but we are not at all sure that all three of these should not be united under one species—*E. fuscus*. The color variations and intergradations are most perplexing. In the field, fresh specimens sometimes show a most diverse coloration, but when brought into the laboratory these differences, to a very large extent, disappear. In life the caudal peduncle, caudal fin, and under parts are inclined to be more decidedly yellow than in alcoholic specimens, but this is not always true. In some instances, as, for example, the majority of specimens obtained at Ponce and Fajardo, the under parts are scarcely less dark than the upper. As a general rule the younger individuals are more profusely covered with brilliant sky-blue spots than are the older ones. As already stated, these spots appear in life as black or very dark-blue, but in alcohol they invariably fade first to sky-blue and finally to white or bluish-white; the spot near the base of last anal ray is usually bluish-white in life, fading to white in spirits.

The blotch on base of pectoral is sometimes bluish, but usually black. Some of the spots on anterior part of head are oblong or linear; the blotch on anterior soft rays of soft dorsal is usually black and irregular in form, though frequently it is beautifully ocellated, the border being a narrow line of bright sky-blue; this ocellus is always present in young examples, but frequently disappears in those of larger size. Except in a very few specimens, which we refer to *E. fuscus*, the spot near the base of the last anal ray is always present; except on certain specimens, which we refer to *E. leucostictus*, and whose colors agree closely with plate 28, there is no sharp contrast between the color of the upper and the lower parts, but where there is any difference at all it is through the gradual change from the dark of the back to the lighter of the ventral parts; except for the constant presence of the spot upon the anal fin, the specimens which we refer to *E. analis* would agree equally well with the prescriptions of *E. fuscus;* but as we have found no specimens without the anal spot, it seems best at present to regard the two forms as distinct. To ascertain the true relations of these species careful field studies in many different localities in the West Indies are necessary.

This species attains a length of 3 to 4 inches. Its proportional measurements are quite constant, as may be seen from the appended table:

Comparative measurements of 33 specimens of Eupomacentrus analis.

Locality.	No.	Length.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Interorbital.	Preorbital.	Scales.	Dorsal fin.			Anal fin.			Pectoral.	Ventral.	Caudal lobes.
												Formula.	Longest spine.	Longest ray.	Formula.	Longest spine.	Longest ray.			
Ponce	29	3.18	3.2	2.13	3.25	3.5	3.5	4.25	3.25	6	2-29-8	XII, 15	1.8	1.4	II, 13	2	1.33	1.33	1	1
Do	688	3.5	3.5	2.13	3.2	3.25	3.25	3.75	3.25	7	2-28-8	XII, 15	1.66	1.17	II, 13	2	1.2	1.2	1	.87
Do	689	3.5	3.5	2.4	3.2	3.2	3.25	3.75	3.66	7	3-28-8	XII, 15	(1)	1.25	II, 13	2	1.2	1.2	1.1	.87
Do	690	3.25	3.4	2	3.2	3.25	3.2	3.25	3.5	7	3-29-8	XII, 15	.....	1.25	II, 13	2	1.25	1.2	1	.87
Do	691	3.36	3.5	2.13	3.2	3.5	3.5	4.25	3.75	7	3-28-8	XII, 15	1.8	1.4	II, 13	2	1.4	1.25	1.1	1
Do	692	3.25	3.4	2.25	3.25	3.5	3.5	4	3.25	7	3-28-8	XII, 15	1.8	1.25	II, 13	2	1.5	1.2	1	.87
Do	693	3.25	3.4	2.1	3.2	3.25	3.5	4	3.75	7	3-29-8	XII, 15	2	1.25	II, 13	2	1.4	1.2	1.1	1
Do	694	3	3.25	2	3.5	3.5	3.5	4	3.5	7	3-29-8	XII, 15	2	1.25	II, 13	2	1.4	1.2	1	.87
Do	695	3	3.4	2.4	3.2	3.4	3.4	4	3.5	7	3-29-8	XII, 15	2	1.25	II, 13	2	1.2	1.2	1	.87
Do	696	3	3.4	2.33	3.2	3.4	3.5	4	3.25	7	2-28-8	XI, 15	2	1.2	II, 13	2	1.25	1.2	1	.87
Do	697	3.5	3.5	2.25	3.5	3.5	3.5	4	3.5	7	3-28-8	XII, 15	2	1.2	II, 13	2	1.2	1.2	1	.87
Do	698	3.25	3.25	2.25	3.25	3.5	3.75	4	3.5	7	3-28-8	XII, 15	2	1.2	II, 13	2	1.2	1.2	1	.87
Culebra	699	4	3.25	2.25	3.75	3.5	3.5	4	3	7	2-26-8	XII, 15	2	1.1	II, 13	1.9	1.2	1.1	.87	.75
Do	700	3	3.4	2.4	3	3.1	3.1	4	3	7	3-28-8	XII, 15	2.1	1	II, 13	2	1.2	1.17	.87	.87
Do	701	3.25	3.5	2.5	3.5	3.2	3.5	4	3	7	3-28-8	XII, 15	1.75	1.1	II, 13	2	1.1	1.1	.87	.87
Do	702	3	3.1	2.25	3.5	3.5	3.25	4	3.5	7	3-28-9	XII, 15	1.75	1.1	II, 13	2	1.2	1.17	.87	.87
Do	703	3	3.33	2.25	3	3.5	3.25	4	3	7	3-28-8	XII, 15	2	1.2	II, 13	2	1.4	1.25	1	1
Do	704	3—	3.4	2.4	3.5	3.5	3.25	4	3.5	7	3-28-9	XII, 14	1.4	1.1	II, 13	1.75	1	1.25	1	.75
Do	705	2.5	3	2.4	3.5	3.5	3.1	4	3.25	7	3-28-8	XII, 14	1.75	1	II, 13	2	1.2	1.25	1	1
Fajardo	706	3.37	3.2	2.4	3.1	3.5	3.2	4	3.5	7	2-27-9	XII, 15	1.5	1	II, 13	1.4	1.2	1.2	.87	.87
Do	707	3.25	3.4	2.5	3.1	3.5	3	4	3.5	7	3-28-8	XII, 15	1.75	1.2	II, 13	1.75	1.2	1.2	.87	1
Do	708	3.25	3.5	2.8	3.5	3.5	3.5	4	3.2	7	3-29-8	XII, 15	1.6	1	II, 13	1.75	1.2	1.2	1.2	.87
Do	709	3.5	3.4	2.5	3.5	3.2	3.5	4	3.5	7	3-28-8	XII, 15	1.6	1	II, 13	1.75	1	1.2	.87	.87
Do	710	3	3.4	2.4	3.5	3.5	3	4	3.4	7	3-28-8	XII, 15	1.6	1	II, 13	1.75	1.2	1.3	.87	.87
Puerto Real	748	3.5	3.4	2.1	3.4	3.7	3.5	4	3.4	7	3-28-9	XII, 15	1.75	1.1	II, 13	1.75	1.1	1.25	1	.87
Do	749	3.5	3.4	2.4	3.5	3.7	3.6	4	3.5	7	3-29-9	XII, 15	1.75	1.1	II, 13	1.5	1.1	1.25	1	.87
Do	750	3.5	3.2	2.4	3.5	3.5	3.6	4	3.5	7	3-29-8	XII, 15	1.75	1.1	II, 13	1.75	1.2	1.25	1	1
Do	751	3	3.1	2.2	3.3	3.5	3.5	4	3.5	7	3-28-8	XII, 15	1.75	1.25	II, 13	1.75	1.4	1.25	1	1
Do	752	3.5	3.5	2.5	3.6	3.5	3.4	4	3.5	7	3-28-8	XII, 15	1.75	1	II, 13	1.75	1.2	1.25	1	.87
Do	753	3.37	3.4	2.1	3.5	3.5	3.4	4	3.3	7	3-29-8	XII, 15	1.6	1.1	II, 13	2	1.2	1.25	1	.87
Do	754	3.37	3.4	2.4	3.5	3.5	3.4	4	3.3	7	3-29-8	XII, 15	1.6	1.25	II, 13	1.75	1.2	1.25	1	1
Do	755	3.5	3.2	2.2	3.5	3.5	3.5	4	3.3	7	3-29-8	XII, 15	1.75	1	II, 13	1.75	1.4	1.25	1	1
Do	756	3.25	3.5	2	3.5	3.7	3.5	4	3.5	7	3-29-9	XII, 15	1.75	1.25	II, 13	2	1.2	1.25	1.4	1

[1] Broken.

West Indies north to Key West; hitherto regarded as only from Havana and Key West. Ninety per cent of the specimens of this genus obtained by us are referred to this species. Specimens were obtained at San Juan, Aguadilla, Mayaguez, Puerto Real, Guanica, Ponce, Hucares, Fajardo, and Culebra; it was exceedingly abundant at Culebra, Fajardo, and Ponce about the coral reefs and around the little islets, every haul of the seine securing several. At Fajardo they were particularly common among the algæ on the west side of the small keys off the Playa.

Pomacentrus analis Poey, Synopsis, 327, 1867, Havana.
Eupomacentrus analis, Jordan & Evermann, l. c., 1554, 1898.

182. Eupomacentrus leucostictus (Müller & Troschel), *Beau Gregory; Cockeye Pilot; Black Pilot.*

(PLATE 28.)

Head 3.5; depth 2; eye 3; snout 3.75; maxillary 3.75; interorbital 3.75; preorbital 6.5; D. XII, 15; A. II, 13; scales 2-29-10. Body compressed; dorsal and ventral outlines similar; profile convex, but less steep than in *E. fuscus* or *E. analis*. Mouth moderate, maxillary reaching anterior part of orbit; jaws equal; teeth in a single band in each jaw, incisor-like and close-set. Preopercle and preorbital distinctly serrate; scales large, firm, strongly ctenoid, reduced in size on head; snout and sides of head completely scaled; lateral line beginning at upper end of gill-opening, arched, gradually approaching dorsal outline as it proceeds backward, ceasing under middle dorsal rays; fins moderate; longest dorsal spines nearly 2 in head; middle rays of soft dorsal elevated, about 1.4 in head; second anal spine long, strong, and gently curved, 2 in head; soft anal similar to soft dorsal, the rays somewhat longer; caudal forked, lobes about equal, upper sometimes slightly the longer; pectoral short, scarcely reaching vent; ventral short, reaching scarcely past vent.

Color: Top of head and back rich dark-blue, sides and under parts abruptly lemon-yellow, this yellow extending over side of head, entire side of body below lateral line and to some extent above it, and entire caudal peduncle and caudal fin; side of head and anterior part of body as well as top of head and dorsal region with numerous small pale-blue spots; similar spots on spinous dorsal and anterior soft dorsal rays, as well as a few on anal fin; a large black blotch on middle anterior dorsal rays, not ocellated. Posterior half of dorsal and anal yellow like caudal; pectoral pale-yellow; pale-blue spot near base of last anal ray; a small black blotch at base of pectoral. In life the pale-blue spots on top of head and upper part of side appear white by contrast with the darker-blue ground-color, those on side of body and head appearing bluer. Along the lateral line are sometimes present a few small, oblong dark spots. The coloration of this species is extremely variable; usually the colors are about as given above, but some specimens showed a gradual encroachment of the blue of the back upon the yellow of the sides, thereby approaching the general color-pattern of what we have called *E. analis.*

The extreme forms of this species and of *E. analis* are remarkably different and one would not hesitate to regard them as entirely different species, but individuals taken from different places and of various sizes, show very perplexing variations. It has, however, been impossible to show that these variations present actual intergradation, and for that reason we prefer, for the present, to recognize the species as distinct.

Found in the West Indies north to southern Florida. In Porto Rico we obtained specimens at San Juan, Puerto Real, Culebra, and Guanica. While fairly common, it is apparently much less abundant than *E. analis.*

Pomacentrus leucostictus Müller & Troschel, in Schomburgk's Exc. Barbados, 674, 1848, Barbados.
Pomacentrus caudalis Poey, Synopsis, 328, 1867, Havana.
Pomacentrus xanthurus Poey, Memorias, II, 190, 1860, Havana.
Pomacentrus dorsopunicans Poey, Synopsis, 328, 1867, Havana.
Eupomacentrus leucostictus, Jordan & Evermann, l. c., 155, 1898.

Genus 105. ABUDEFDUF Forskål. Pintados.

Body deep, compressed, covered with large ctenoid scales; snout without scales; preopercle and preorbital entire, lower limb of preopercle scaleless; 3 to 4 rows of scales between lateral line and dorsal; teeth compressed, fixed, more or less distinctly emarginate, in one series in each jaw, those below occupying most of free edge of jaw; jaws subequal. Dorsal usually with 13 spines, the last slightly shorter than median ones; branchiostegals 5 or 6; pyloric cæca 3. Lower pharyngeals triangular.

Species numerous, often brightly colored, about coral reefs in the tropical seas. We exclude from this genus all the species formerly referred to *Glyphidodon*, in which the teeth are in more than one series, and also those in which the snout is scaly or the lower pharyngeals not triangular. For these forms different generic names, *Hemiglyphidodon*, *Amblyglyphidodon*, *Glyphidodontops*, etc., have been defined by Bleeker. The genus *Stegastes* Jenyns (*imbricatus*) is also very close to *Abudefduf*, but it seems to have entire teeth, and the snout and fins are densely scaly. The genus *Nexilarius* is less closely related to *Abudefduf.*

GLYPHISODON:
- *a.* Preopercle entire.
  - *b.* Preorbital very narrow, its least breadth less than pupil, even in adult; anterior profile of head nearly straight, snout rather acute; dorsal spines 13; anal with about 12 soft rays.
    - *c.* Scales about 4-30-11; green, with about 6 dark-blue or blackish crossbands; depth 1.75 to 2 in length; anal rays II, 12 .... *saxatilis*, 183

EUSCHISTODUS:
  - *bb.* Preorbital broad, its least breadth not less than diameter of pupil, greater than pupil in adult; anterior profile of head more or less arched, snout low and blunt, projecting beyond the small mouth; anal rays II, 10; coloration dull.
    - *d.* Dorsal spines 13; scales 27 or 28.
      - *e.* Color in adult brownish, with green dots, not distinctly banded; teeth smaller, $\frac{2}{2}\frac{1}{5}$ on each side .... *analogus*
    - *dd.* Dorsal spines 12; body with 5 dark crossbands, fainter than in *A. saxatilis;* scales about 25 .... *taurus*
- *aa.* Preopercle said to be coarsely serrate; dorsal spines 13; scales very large, 25; body with dark crossbands ..... *rudis*

183. Abudefduf saxatilis (Linnæus). *Cockeye Pilot; Demoiselle; "Chirivita"; "Pintado."*

Head 3.2; depth 1.8; eye 3.2; snout 3.5; interorbital 2.7; D. XIII, 13; A. II, 12; pectoral 0.9; ventral 1.0; caudal 0.8; scales 5-28-11.

Color in spirits: Chiefly silvery, somewhat darker above, top of head brown; side with five vertical brown bars, largest as wide as eye, first from front of dorsal to base of pectoral, second downward from fourth, fifth, and sixth spines, third from ninth and tenth spines toward vent, fourth from last spines to middle of anal, fifth from soft dorsal across peduncle upon anal; sometimes a faint sixth bar upon base of caudal; first four not reaching belly; axil dark, front of base of pectoral black. Smaller individuals (2 inches and less) have, in spirits, ground-color nearly everywhere uniform light-brown, made up of small punctulations. In life the color is not much different; the interspaces are brassy-yellow, fading to white on side; head and fins pale-bluish.

This species, which reaches a length of 6 inches, is found in tropical America on both coasts; abundant in tide-pools and about coral reefs from Guaymas to Peru and Florida to Uruguay, but much less abundant than the species of *Eupomacentrus*. It is common about Porto Rico, but difficult to capture, as it is found chiefly where nets can not be used to advantage. We have specimens, from 0.75 to 5.5 inches, from San Juan, Puerto Real, and Culebra.

Chætodon cauda bifurca, fasciis S. albis, Linnæus, Mus. Adolph. Frederici, I, 64, "India."
Chætodon saxatilis Linnæus, Syst. Nat., ed. X, 276, 1758; after Mus. Ad. Fr.
Chætodon mauritii Bloch, Ichthyol., III, 213, pl. 109, 1785, Brazil; on a bad drawing by Prince Maurice
Chætodon marginatus Bloch, Ichthyol., III, 98, pl. 207, 1787, Martinique; on a drawing by Plumier.
Glyphisodon moucharra Lacépède, Hist. Nat. Poiss., IV, 542, 1803, Brazil, etc.: after various authors.
Chætodon sargoides Lacépède, Hist. Nat. Poiss., IV, 453, 1803, Martinique; on a drawing by Plumier.
Glyphidodon troschelii Gill, Proc. Ac. Nat. Sci. Phila. 1862, 150, Cape San Lucas.
Glyphidodon saxatilis Poey, Fauna Puerto-Riqueña, 336, 1881; Stahl, l. c. 77 and 164, 1883.
Abudefduf saxatilis, Jordan & Evermann, l. c., 1561, 1898.

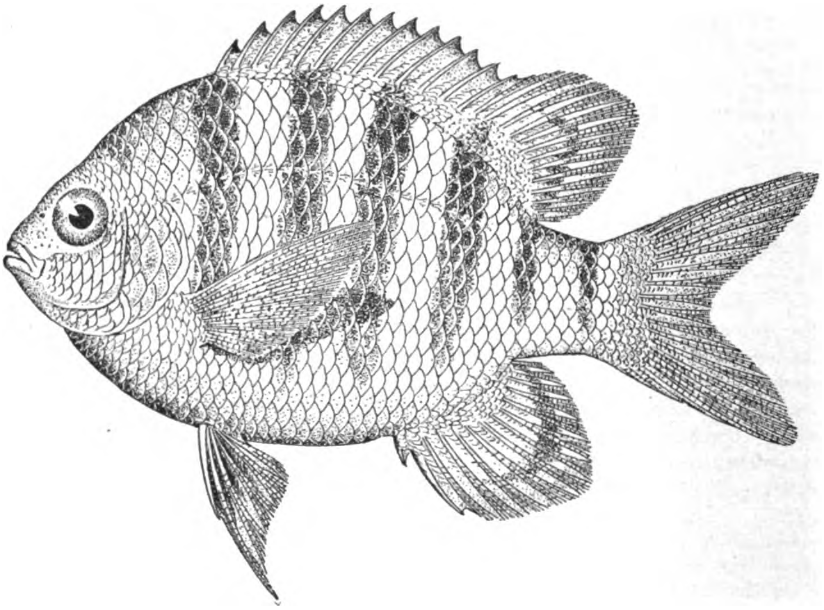

FIG. 64.—*Abudefduf saxatilis.*

Family LI. LABRIDÆ. The Wrasse-fishes.

Body oblong or elongate, covered with cycloid scales; lateral line well developed, continuous or interrupted, often angularly bent. Mouth moderate, terminal; premaxillaries protractile; maxillaries without supplemental bone, slipping under the membranaceous edge of preorbital; anterior teeth in jaws usually very strong and canine-like; teeth of jaws separate or soldered together at base, not forming a continuous plate; no teeth on vomer or palatines; lower pharyngeals completely united into one bone, without median suture, this bone T-shaped or Y-shaped, its teeth conical or tubercular. Lips thick, longitudinally plicate. Nostrils round, with 2 openings on each side. Dorsal fin continuous, spinous part usually long, its spines rather slender, 3 to 20 in number; anal similar to soft dorsal, with 2 to

6 spines. Ventrals thoracic, I, 5, inserted below pectorals. Branchiostegals 5 or 6; pseudobranchiæ well developed; gills 3.5, slit behind last arch small or obsolete; gill-membranes somewhat connected, sometimes joined to narrow isthmus. Air-bladder present; no pyloric cæca.

This family comprises 60 genera and 450 species, chiefly of the tropical seas, living among rocks or kelp, many of them brilliantly colored and some valued as food-fish. Most of them feed upon mollusks, the dentition being adapted for crushing shells. As in most other large groups there is considerable difference of opinion as to the characters which should be used in dividing the Labroids into genera. The tendency with all recent writers has been toward a rather minute subdivision. The numbers of vertebræ seem to us to yield characters of the highest importance. Other characters not to be neglected can be drawn from the size of the scales, the numbers of the dorsal spines, and the dentition. The degree of squamation of the head seems to us to have an importance lower than that attributed to it by Bleeker and Günther, but it may be used for generic subdivision.

a. Dorsal spines 8 or more, usually well distinguished from soft rays; anal spines 2 to 6.
b. Vertebræ and dorsal spines not in greatly increased numbers; vertebræ 22 to 29; dorsal spines 8 to 13; anal spines 2 or 3; species of tropical or subtropical seas.
c. Vertebræ 27 to 29 (so far as known); dorsal spines usually 12 (11 to 14); sides of head more or less scaly; preopercle serrulate or entire.

HARPINÆ:

d. Anterior canines strong; lower pharyngeals large, with large, tubercular teeth; spinous dorsal not enveloped in scales; lower jaw naked; species mostly of large size and bright coloration, inhabiting semitropical seas.
e. Dorsal spines about 14, the 3 or 4 anterior falcate, produced in long streamers; body deep and compressed, anterior profile steep; teeth uniserial; no posterior canine; cheek and opercles scaly; bases of soft dorsal and anal scaly; soft parts of vertical fins produced; scales moderate (40)............................ LACHNOLAIMUS, 106
ee. Dorsal spines 11 or 12 (rarely 13), none of them produced in filaments; cheek and opercles scaly; body oblong; back not greatly elevated.
f. Soft dorsal and anal each with a scaly sheath at base; scales large (about 32); posterior canine present; soft dorsal and anal elevated, produced behind... HARPE
ff. Soft dorsal and anal without sheath of scales; preopercle serrulate (at least in young); soft dorsal and anal more or less falcate.
g. Scales large, about 30; lower limb of preopercle scaly; posterior canine present; anterior canines $\frac{4}{4}$...... DECODON

CLEPTICINÆ:

dd. Anterior teeth small, bluntish, not canine-like; no posterior canine; mouth very small, terminal; snout short and blunt; dorsal and anal enveloped in scales, except produced tips of both fins; caudal deeply forked; dorsal spines almost hidden by series of scales; head everywhere closely scaled, except on lips and snout; scales of body large; preopercle serrulate; gillrakers slender, short; pectoral falcate; lower pharyngeals very small, Y-shaped, their teeth small, very blunt, and coalescent; vertebræ 10 + 17=27; dorsal spines, 12..... CLEPTICUS
cc. Vertebræ 23 to 26; dorsal spines 8 or 9; anterior canines strong, 2 to 4 on each side in each jaw; head mostly naked; preopercle entire. Species of the Tropics, mostly of small size and bright coloration.

JULIDINÆ:

h. Lateral line complete and continuous.
i. Snout not tubiform; preopercle entire; teeth uniserial, none chisel-shaped.
j. Cheeks and opercles naked.
k. Scales large, 25 to 30 in lateral line; anal spines 2 or 3.
l. Dorsal spines 9; dorsal enlarged, without scaly sheath; scales of breast not enlarged.
m. Anterior canines all normal in position; lower pharyngeals T-shaped, with numerous teeth; anal spines 3.
n. Posterior canine well developed on both sides; dorsal spines pungent; anterior canines $\frac{2}{4}$.............. IRIDIO, 107
ll. Dorsal spines 8; no posterior canines; anterior canines $\frac{2}{2}$, normal in position; a low sheath of scales at base of dorsal; dorsal spines pungent; anal spines 3, never 2..CHLORICHTHYS

XYRICHTHYINÆ:

hh. Lateral line interrupted posteriorly, beginning again on level of axis of body, on caudal peduncle; scales large, 20 to 30 in lateral line; dorsal spines 9; anal spines 3; anterior canines $\frac{2}{2}$.
o. Posterior canine present; snout slender, anterior profile not convex; cheek and opercles scaly; dorsal spines pungent, the three anterior longer and with filamentous appendages; dorsal and anal with a scaly sheath; scales very large .... DORATONOTUS, 108
oo. Posterior canine none; anterior profile more or less convex; head naked, except usually a few scales below eye; body more or less strongly compressed; ventrals thoracic, inserted below the pectorals.
p. Scales very large, about 20 in lateral line, which is placed on first row of large scales below dorsal sheath; anterior dorsal spines not detached; head not trenchant above .... XYRULA
pp. Scales large, about 26 in lateral line, which is placed on second row of large scales below dorsal sheath.
q. First two dorsal spines joined by membrane to the others and inserted nearly above base of pectoral.
r. Upper anterior profile of head not trenchant, curve of head not parabolic; cheek not very deep... NOVACULICHTHYS
rr. Upper anterior profile of the head sharply trenchant, its curve parabolic; cheek very deep, eye near upper profile .... XYRICHTHYS

Genus 106. LACHNOLAIMUS Cuvier & Valenciennes.

Body strongly compressed, back sharp and elevated, profile long and steep. Snout sharp; mouth low, horizontal, jaws narrow; premaxillary slipping under membranaceous edge of the very broad preorbital, which is twice depth of eye. Teeth in front prominent, canine-like, in a single series; no posterior canines. Cheek and opercles with imbricate scales; scales of moderate size, thin, adherent; lateral line complete. Dorsal with 14 spines, first 3 strong, falcate, produced in long streamers in adult, membranes between these spines very low, filamentous tips longer than head; other spines all low, gradually shorter to the eleventh; second dorsal and anal much produced; caudal lobes falcate; third anal spine strong; pectoral and ventrals short.

This genus contains a single species, a large, showy fish of tropical America, remarkable for the long, streamer-like filaments on the dorsal spines.

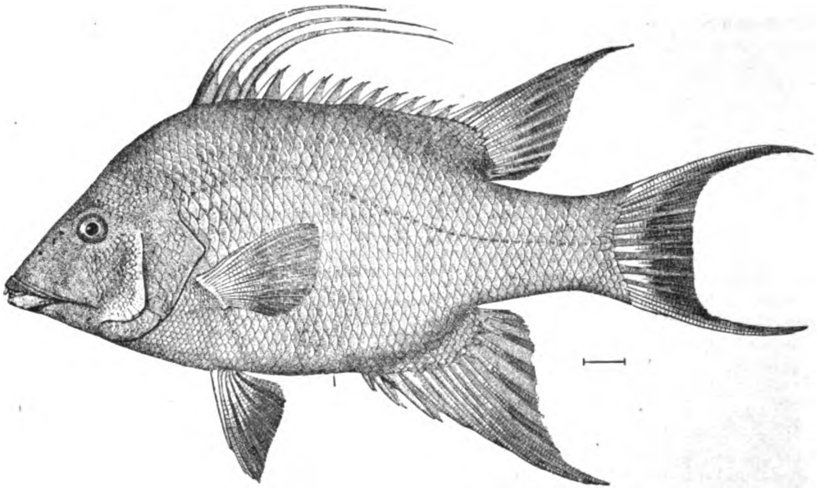

FIG. 65.—*Lachnolaimus maximus.*

184. Lachnolaimus maximus (Walbaum). "*Capitan*"; *Perro Perro; Hog-fish.*

Head 3; depth 2.2; eye 5.4; snout 2.4; maxillary 2.1; mandible 2; interorbital 4.1; preorbital 4.4; D. XIV, 11; A. III, 10; pectoral 1.6; ventral 1.6; caudal 1; scales 8–38–14. Body deep and compressed, back elevated, anterior profile long and steep, nearly straight, slightly concave before eye; scales rather large and thin; premaxillaries very protractile; 4 strong canines in front of upper jaw, 1 pair in front of lower with 2 smaller conical teeth between them; sides of jaws with small, uniserial, bluntly conical teeth; first 3 dorsal spines produced in long filaments, reaching to end of fin, rest of spines low; soft dorsal with anterior rays somewhat elevated, nearly as long as head; caudal deeply lunate.

Color in life, brick-red, scales edged with reddish-yellow thus giving a cross-hatched appearance; a large black spot on last 4 dorsal rays and body at their base; caudal red, with 2 pale-brown crossbars and 2 spots of same on each tip, anal similar to caudal; ventral dark purplish-red; pectoral lemon; purplish lines radiating downward and forward from eye. In spirits, grayish, snout blackish; caudal with 2 faint vertical dark bars near base; base of last rays of soft dorsal with deep black spot extending upon body. The sexes differ in color and in size of mouth, and individuals vary much with age, but the species may be known at once from the long dorsal streamers.

"El Capitan" is found throughout the West Indies and north to Key West and the Bermudas, abundant about reefs and rocks. It has been recorded from various places in southern Florida, the Tortugas, Bahamas, St. Bartholomew, Cuba, Martinique, St. Thomas, Santo Domingo, Porto Rico, and Jamaica. Examples, 6 to 13 inches long, were obtained at Ensenada del Boqueron, Arroyo, and Isabel Segunda. Others were seen in the fishermen's boats at each of these places and also at Culebra Island.

This is a large and showy fish, reaching a weight of 10 to 15 pounds, or even 20 pounds in the Bermudas. It changes much in appearance in the course of its growth, which accounts for the many specific names it has received. The large adult male is remarkable on account of a heavy black blotch over the forehead and eyes. The name "hog-fish" refers to the swine-like appearance of the head, jaws, and teeth. Like all other members of the family, it feeds chiefly upon small fish and upon bottom mollusks and crustaceans. It is an important food-fish, throughout its range and is one of the most common and attractive species seen in the wells of fishing boats at Key West. It is a favorite food-fish in Cuba, though at one time its sale was forbidden by law on account of the supposed poisonous character of its flesh. This opinion obtains to some extent in Porto Rico, but apparently the flesh of only the large individuals is believed to possess any deleterious properties. Whether there is any good reason for this belief is doubtful.

Suillus (the Great Hog-fish), Catesby, Nat. Hist. Carolina, etc., pl. 15, 1750, Bahamas.
Labrus maximus Walbaum, Artedi Piscium, 261, 1792.
Lachnolaimus suillus Cuvier, Règne Animal, ed. II, vol. 2, 257, 1829, Bahamas; after Catesby.
Lachnolaimus aigula Cuvier & Valenciennes, Hist. Nat. Poiss., XIII, 277, 1839, St. Bartholomew.
Lachnolaimus dux Cuvier & Valenciennes, Hist. Nat. Poiss., XIII, 285, Martinique.
Lachnolaimus caninus Cuvier & Valenciennes, Hist. Nat. Poiss., XIII, 288, 1839, St. Thomas and Santo Domingo.
Lachnolaimus psittacus Cuvier & Valenciennes, Hist. Nat. Poiss., XIII, 291, 1839, Porto Rico.
Lachnolœmus suillus Poey, Fauna Puerto-Riqueña, 336, 1881.
Lachnolaimus maximus, Jordan & Evermann, l. c., 1579, 1898.

Genus 107. IRIDIO Jordan & Evermann. Doncellas.

Body oblong, compressed, not elevated, covered with large scales, there being 25 to 30 in course of lateral line, which is not interrupted, but abruptly bent posteriorly. Scales on breast rather smaller. Head naked, compressed, conic. Preopercle entire. Teeth large, upper jaw with 2 strong canines in front, none of them bent backward; lower jaw with 4 anterior canines, a posterior canine tooth directed forward on each side of upper jaw. Dorsal spines 9; anal spines 3, graduated; ventrals inserted under axil of pectoral. Gillrakers short and feeble; gill-membranes slightly joined to a narrow isthmus. Vertebræ $10 + 15 = 25$.

There are numerous species of this genus, most of them brilliantly colored, abounding in kelp in the tropical seas. All of them are American. The genus is very close to the Old World *Halichœres*, differing chiefly in the dentition and in the presence of 3 anal spines instead of 2.

a. Caudal fin very slightly concave, truncate when spread open, outer rays longer than middle ones; body deep and compressed, depth about 2.75 in length; ventral fins filamentous, outer ray produced, more than twice as long as inner ray; scales before dorsal not crossing middle line, in about 5 series.

b. Side below spinous dorsal without dark crossbar; general color bluish (male), or bronze (female), with many sky-blue spots, most distinct posteriorly; sky-blue spots and streaks on head; a stripe passing through upper part of eye; fins with blue stripes; a dark axillary spot; end of pectoral dusky.................................... *radiatus*

bb. Side below spinous dorsal with a very broad, blackish cross-bar.................................... *kirschii*, 186

aa. Caudal fin rounded or subtruncate, outer rays not produced, shorter than middle rays.

c. Scales before dorsal large, in 4 to 6 rows, not crossing median line; snout moderately pointed.

d. Ventral fins with outer ray produced, more than twice length of inner.

e. Side without conspicuous dark lateral band and with a distinct dark vertical bar, extending downward from spinous dorsal; axillary spot obscure; body rather elongate, depth about 3.75 in length; profile not steep; posterior canines rather small; head with black streaks and spots above; caudal sharply barred........... *garnoti*

ee. Side with a broad blue-black lateral band extending from eye to tip of caudal; back above this, dark brown or bluish; spinous dorsal with no conspicuous black spot; a dark-blue stripe from eye to nape; fins mostly blue-black with pale edgings; middle and base of caudal dusky; tip of pectoral dusky; profile rather steep; body rather robust, depth 3.33 in length.................................... *cyanocephalus*

dd. Ventral fins with outer ray not produced, its length not more than twice that of inner rays; side with a dark lateral band; species of small size.

f. Spinous dorsal with a conspicuous blue-black spot between fifth and seventh spines; body not very slender, depth 3.8 in length; a dark band from snout through eye to opercle, lateral band on side broader than eye and placed a little above opercular band, lateral band extending nearly to tip of caudal; no second dark band below it; a faint dark spot under last dorsal ray and one at base of pectoral above; 2 or 3 narrow bluish-white stripes across cheek: body and fins in life with bright colors which fade in alcohol......................... *maculipinna*

ff. Spinous dorsal pale, black spot very small or wanting; body slender, depth 4 in length; opercle with a conspicuous black spot; a blue-black band from snout through eye and across opercles to base of caudal, not extending on fin; a narrower and fainter band from lower base of pectoral to above anal, these bands growing fainter with age and sometimes disappearing, lower always wanting in adult; no axillary spot; no distinct bands across cheek; fins mostly pale, with bright red and blue colors in life, young and deep-water individuals often showing a black spot at base of caudal and sometimes a dark spot near middle of dorsal, with sometimes a larger one at base of its last ray; angles of caudal black in adult; lower pharyngeals T-shaped, the anterior limb very short.................................... *bivittatus*, 185

aaa. Caudal fin double-concave, median portion convex, outer rays more or less produced in adult (fin rounded in young); scales before dorsal in 6 or 7 rows, not crossing median line; a blue-black spot close behind eye, sometimes obsolete in adult.

g. Lateral line without blue-black spot; ventrals with outer rays scarcely filamentous, about reaching tips of pectorals.

h. Tubes of pores of lateral line distinctly branched, branches usually 3 in number; body moderately slender, depth a little less than length of head and 3.75 to 4 in body; head 3.4.

i. Eye large, 1.66 in snout.

ii. Eye small, 2.66 in snout; brownish above, bright violet-red below; many blue spots above; a crescent on base of pectoral; caudal edged with violet and with convergent streaks of yellow.................................. *poeyi*

hh. Tubes of pores of lateral line all simple or very nearly so, not trifid; body very slender, depth much less than length of head, 4.5 in body; head 3.4; snout very sharp, anterior profile of head straightish and not steep; snout 2.8 in head; eye 2 in snout; pectoral moderate, 1.6 in head; color in spirits, pale, unmarked, except for small black spot behind eye.

j. Color in life, olive-green, bluish below; back with blue spots; a yellow band on side with vague outlines; posterior parts paler, with rows of blue spots; head with blue bands; dorsal and anal rosy, with blue spots..... *caudalis*

jj. Color in life, olivaceous; a broad band-like area of orange mingled with violet spots along side backward from head to middle of body, lower edge of this band serrate; below this a pale-violet band, darker behind; still lower a yellow stripe; head olivaceous, marked with blue; preorbital scarlet, with 3 violet stripes; opercles bright red, with 3 violet stripes, postocular black spot in the uppermost; dorsal and anal orange and yellow, with blue spots; caudal with convergent bands of orange forming reticulations around blue spots....... *pictus*

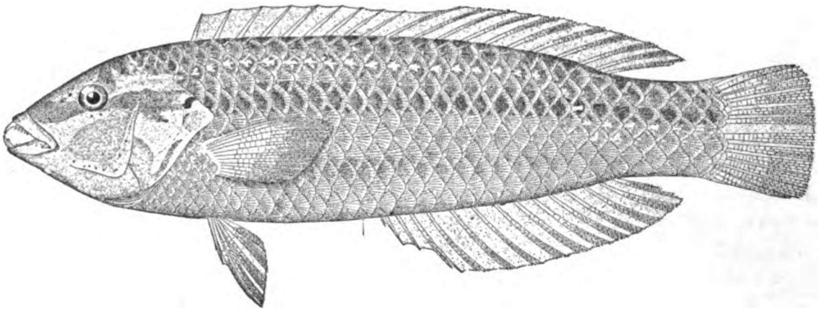

FIG. 66.—*Iridio bivittatus.*

185. Iridio bivittatus (Bloch). *Slippery Dick; Doncella.*

Head 3.2; depth 4; eye 6.3; snout 3; interorbital 4.7; preorbital 4.7; D. IX, 11; A. III, 12; pectoral 1.7; ventral 1.9; caudal 1.6; scales 2–28–8. Scales before dorsal reduced in size, in about 4 rows, not crossing median line; ventral fin with first ray moderately produced, about twice inner ray; caudal slightly rounded.

Color in spirits: Grayish, a purple band from snout through eye to base of caudal, much widened on opercle; a fainter band, more blue, from base of pectoral to above end of anal; an oblong purple-black spot on upper edge of opercle, bordered behind by blue; a blue band from nape to eye; chin with a blue transverse band. An example, 2.5 inches long, has longitudinal bands brown, traces of very faint vertical dark bars, and 2 small dark spots near base of front of soft dorsal.

This species is gorgeous in color, but of little value as food, the flesh being dry and insipid. It is found throughout the West Indies, north to Pensacola and Beaufort, N. C., and south to Brazil, and is usually very abundant along weedy shores and reefs. Specimens, 2.5 to 5.5 inches long, obtained at Mayaguez, Fajardo, and Culebra; 4 from San Geronimo.

Sparus radiatus Linnæus, Syst. Nat., ed. XII, 472, 1766, Carolina; not *Labrus radiatus* L., ed. X.
Labrus bivittatus Bloch, Ichthyol., pl. 284, fig. 1, 1792; from a painting by Plumier, made at Martinique.
Labrus psittaculus Lacépède, Hist. Nat. Poiss., III, 522, 1800, Martinique; from a copy of Plumier's painting.
Julis humeralis Poey, Memorias, II, 212, 1860, Havana; adult.
Chærojulis grandisquamis Gill, Proc. Ac. Nat. Sci. Phila. 1863, 206, Beaufort, N. C.
Chærojulis arangoi Poey, Enumeratio, 109, 1875, Havana; young.
Platyglossus florealis Jordan & Gilbert, Proc. U. S. N. M. 1882, 287, Pensacola; young.
Iridio bivittatus, Jordan & Evermann, l. c., 1595, 1898.

186. Iridio kirschii Jordan & Evermann.

Head 3.4; depth 4; eye 5.5; snout 3; D. IX, 12; A. III, 11; scales 2–28–8. Body elongate, compressed; anterior profile gently convex; head rather long; snout pointed; mouth moderate, horizontal, maxillary not reaching vertical of eye by half its diameter; teeth strong, curved; opercular flap long, reaching past base of pectoral; caudal peduncle compressed, its least width 5 times in its least depth;

scales large, about 4 rows in front of dorsal fin, scales not extending across median line; tubes of pores of lateral line distinctly branched, branches usually 3 in number, lateral line running on third row of scales to near vertical of last dorsal ray, where it drops to fifth row. Fins moderate; longest dorsal spine about 3 in head, rays about 2.5; anal similar to soft dorsal; pectoral 1.5 in head; ventral with outer rays somewhat produced, about twice length of inner ray, or 1.75 in head; caudal fin almost truncate, slightly, if at all, double-concave.

Color in life: Side beautiful pale-green; scales of back and upper part of side pale-brown at base; under parts greenish-white; a rich green axillary spot and a few scales above it with rich-green edges; pectoral brick-red on base, followed by a narrow blue bar, then by a broader lemon-colored bar, the red bar on base extending on body about 3 scales below pectoral; cheek lemon-colored, a rosy bar from mouth to base of pectoral, another from mouth to eye, and 2 others from preopercle across opercle, a narrow, wavy, rosy line under eye, a somewhat paler bar from mouth downward upon lower jaw, and another forward on snout, meeting its fellow in front; a rich blue postocular spot, with a small yellow one above it; humeral region rich green; a small black spot at base of last dorsal ray; dorsal and anal fins lemon; numerous short rosy bars crossing dorsal, which is bordered by rosy; anal base rosy, then a narrow green stripe, followed by a very narrow pale border; caudal pale greenish-lemon, with rosy on middle rays; pectoral pale-greenish; ventral white with slight rosy wash; iris green and red, pupil black. In alcohol all the colors fade to a yellowish olivaceous, the postocular spot and the one at base of last dorsal ray becoming black.

Found in the West Indies, south to Bahia; recorded from Cuba, Jamaica, St. Croix, and Bahia. The species reaches a foot in length. Two specimens, each 4.25 inches long, in the collections from Porto Rico—one from San Antonio Bridge, the other from Fajardo. We have compared our specimens with the type of *I. kirschii* (No. 43303, U.S.N.M.) and find them to agree perfectly.

Iridio kirschii Jordan & Evermann, Check-List of Fishes of North and Middle America, 413, 1896, Bahia; name only; Jordan & Evermann, Fishes North and Middle America, 1598, 1898.

Genus 108. DORATONOTUS Günther.

Body compressed; head not compressed to an edge anteriorly, its profile in front straight or concave; preorbital not very deep; mouth rather wide; teeth in a single series, 2 large canines in front of each jaw; a posterior canine; cheek and opercles scaly; gill-membranes united, free from isthmus; scales large; lateral line interrupted behind, beginning again lower down; dorsal fin with 9 strong pungent spines, some of the anterior elevated, median spines short, so that the outline of fin is concave; caudal rounded. Colors brilliant. Size small. This genus contains two known species, among the most beautiful of the *Labridæ*, and the genus to which they belong is one of the best defined in the group.

a. Scales large 1.5-20-6.5; color grass-green, over entire body and caudal fin.................................... *megalepis*, 187
aa. Scales smaller, 1-26-6; caudal fin white, with 2 small reddish-brown spots.................................... *decoris*, 188

187. Doratonotus megalepis Günther.

Head 2.75; depth 2.66; D. ix, 10; A. iii, 9; scales 1½-20-6½. Body much compressed, moderately elevated, its greatest width behind the head two-sevenths of its height; caudal peduncle short and deep, its length but little more than one-half its height; profile from dorsal to nape convex, carinated; occiput and supraorbital region depressed and flat, snout protruding, profile of top of head thus strongly concave. Snout slender, sharp, compressed, its length 3.2 in head; mouth wide; maxillary 4 in head; teeth growing gradually larger anteriorly, the 2 front teeth in each jaw distinctly the largest, canine-like, diverging, opposed to each other; a small but distinct posterior canine in upper jaw, none in lower; eye moderate, little wider than interorbital width, 5 in head; cheek with a single series of large scales, 4 in number; opercle covered with 5 or 6 similar scales; gill-membranes broadly united, free from isthmus. Dorsal spines robust and pungent, the first 3 with conspicuous filamentous appendages; first and second spines with their filaments about equal, 1.5 in head; without their filaments second spine is slightly the longer, equaling distance from end of snout to middle of eye, the fin rapidly descending to fourth spine, which is one-half as long as second, then gradually rising to ninth and highest, which is, however, shorter than the following soft rays; longest soft ray 1.66 in head; anal spines similar to those of dorsal fin, the longest about one-half head; caudal evenly convex, its longest ray 1.5 in head; ventrals short, about one-half length of head, an elongate scale between them at base; pectoral reaching beyond ventrals, but not to vent, 1.75 in head; membranes of vertical fins with elongate scales on basal portion; lateral line following outline of back 1 scale beyond end of dorsal fin, thence interrupted and continued on 4 scales of middle of caudal peduncle.

Color in life: Very intense grass-green, about uniform over the body; head more yellowish, slightly paler below; opercle mesially a little darker; iris red, with a green ring; dorsal, anal, and caudal grass-green, mottled with light-orange; tips of lower spines green, of short ones orange; ventrals deep-green, membranes largely orange; pectoral light-yellowish.

Found in the West Indies north to Key West, rare. Length 2.75 inches. Here described from the type of *Doratonotus thalassinus*, obtained with a seine in eelgrass at Key West. The Porto Rican collections contain but a single specimen of this beautiful little species. It is 1.75 inches long and was seined among the algæ at Hucares.

Doratonotus megalepis Günther, Cat., IV, 125, 1862, St. Kitts; Jordan & Evermann, l. c., 1611, 1898.
Doratonotus thalassinus Jordan & Gilbert, Proc. U. S. N. M. 1884, 28, Key West.

188. **Doratonotus decoris** Evermann & Marsh.

(PLATE 29.)

Head 2.6; depth 3.4; eye 4; snout 3.5; maxillary 4; interorbital 4.6; D. IX, 10; A. III, 9; pectoral 1.6; ventral 2.2; caudal 1.6; scales 1–26–6. Body moderately elongate, compressed throughout; back a little elevated, caudal peduncle deep and rather long; dorsal and ventral outlines nearly alike, dorsal somewhat more strongly arched; anterior profile not trenchant, almost straight from snout to front of dorsal, very slightly convex in front of dorsal and very slightly concave between eye and tip of snout; head pointed, interorbital space broad and flat; eye large, high in position, middle of pupil nearer tip of snout than end of opercle; snout long, somewhat longer than diameter of eye, moderately produced, lips broad in front, characteristically labroid; mouth not large, maxillary not reaching front of orbit, the jaws equal, armed with strong sharp teeth, about 4 canines in front of upper jaw, 2 in front of lower; teeth on sides of jaws also canine-like, smaller than those in front, but not distinctly different from them; a few smaller teeth behind the main row of large ones; vomer and palatines toothless; soft dorsal and anal each with a basal sheath of about two rows of large scales, that of dorsal extending over half the fin or more, that of anal lower, the fins otherwise naked; dorsal fin continuous, with a shallow notch, spines slender and pungent, second longer than first, following ones graduated to fifth, which is shortest, thence increasing in length to ninth, which is longest, 2.3 in head; soft dorsal with its middle rays highest, 2.2 in head; anal with three slender, sharp, graduated spines, third longest, 2.2 in head; soft part similar to soft dorsal, longest rays 2.3 in head; pectoral large, symmetrical, of 11 rays, middle ones longest, reaching past tip of ventral nearly to the vent; ventral moderate, pointed, reaching halfway to vent; caudal rounded; scales large, cycloid, lateral line on second row below dorsal, interrupted near end of dorsal and beginning again on row below, on caudal peduncle.

Color in life: Body chiefly green, darker green on back, lighter below; lower parts of head and breast light yellow; a broad white bar from eye obliquely across cheek and opercle, bordered above by an undulating maroon line and below by a similar but fainter line; a brown bar from eye to snout; 4 dusky spots near base of dorsal extending as fainter shades downward and slightly forward to or beyond lateral line, 1 from in front of dorsal, 2 under spinous dorsal, and 1 under soft rays; short pale-blue bars or spots on breast and about pectoral; iris blue, a pinkish border surrounding pupil; dorsal greenish, soft part with yellow shade, a pale-blue edging to whole fin, a maroon border to green color posteriorly just inside the pale-blue edge, a small dark spot on membrane between seventh and eighth rays and a blue spot on membrane of first spine; anal colored like soft dorsal, the maroon border extending from first spine to last ray inside the pale edging, the dark spot between sixth and seventh rays; ventral green near base, pale-blue outwardly, the green color bordered by maroon spots; pectoral plain pale-green; caudal very pale transparent blue, a wedge-shaped maroon spot on the 2 upper rays near tip and a corresponding one on the 2 lower rays, base of wedge on outer ray; base of caudal with a pale undulate vertical bar bordered in front by a black line. In spirits, pale-green, maroon markings faintly persistent, becoming dusky.

One specimen, the type (No. 49363, U. S. N. M), 1.45 inches long, taken in the seine at Ponce, January 30, 1899. Two other specimens were seined in the algæ on a little sandy islet near Playa de Ponce, but they were inadvertently lost. This is one of the most beautiful of fishes and differs from *D. megalepis* chiefly in the smaller scales and the coloration.

Doratonotus decoris Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 354, Ponce, Porto Rico.

FAMILY LII. SCARIDÆ. The Parrot-fishes.

Body oblong, moderately compressed, covered with large cycloid scales as in the *Labridæ*. Mouth moderate, terminal. Teeth in jaws more or less coalescent, at least at base; lower pharyngeals much enlarged, united in a concave or spoon-shaped body, their teeth broadest transversely and truncate, arranged in mosaic; dorsal continuous, usually IX, 10; A. II, 9; 23 to 25 scales in lateral line; vertebræ about 11 + 14 = 25. Sexes similarly colored, the coloration almost always brilliant. Fin rays essentially the same throughout the group, the squamation varying little except on head.

The *Scaridæ* comprise 7 genera and about 110 species, herbivorous fishes of the tropical seas, especially abundant about coral reefs; often of large size, not much valued as food, the flesh being soft and pasty. The species in the various genera are very closely related, being distinguished chiefly by the coloration and the dentition, both series of characters being highly specialized. Jordan & Evermann recognize 5 genera of *Scaridæ* as inhabiting the waters of America north of Panama, of which only 3 are as yet known from Porto Rico.

SPARISOMATINÆ:
- *a*. Lower pharyngeal broader than long, flattish or basin-shaped; gill-membranes broadly joined to isthmus, not forming a fold across it; lateral line subcontinuous; scales about head few and large, those on cheek in one row; lower jaw projecting; teeth whitish or rosy.
  - *b*. Dorsal spines flexible; teeth more or less distinct, at least anteriorly.
    - *c*. Teeth in each jaw in few series, not imbricated or quincunx; lateral teeth of each jaw coalescent in a more or less continuous cutting edge, teeth more free anteriorly and not adnate to dental plate .... CRYPTOTOMUS
  - *bb*. Dorsal spines stiff, pungent; teeth of upper jaw more or less coalescent.
    - *d*. Teeth of each jaw chiefly coalescent, jaws divided by a rather indistinct median suture .... SPARISOMA, 109

SCARINÆ:
- *aa*. Lower pharyngeal spoon-shaped, much longer than broad; teeth of jaws fully coalesced, each jaw divided by a distinct median suture; gill-membranes forming a fold across isthmus; dorsal spines flexible; lateral line interrupted behind, beginning again lower down on caudal peduncle of tail; scales about head rather numerous, those on cheek in two or more series; lower jaw included.
  - *e*. Teeth and jaws whitish or rosy in color .... SCARUS, 110
  - *ee*. Teeth and jaws blue or bluish-green .... PSEUDOSCARUS, 111

Genus 109. SPARISOMA Swainson. Viejas.

Lower pharyngeal broader than long, subhexagonal, its surface moderately concave or flattish; teeth in each jaw largely coalescent in adult, their tips more or less separate in young, the edge, especially of lower jaw, remaining uneven; median suture in each jaw present, but not well defined; 1 to 4 radiating canines sometimes present on each side of upper jaw above its cutting edge; gill-membranes broadly united to isthmus; dorsal spines pungent; upper lip double for its entire length; lower jaw projecting beyond upper; lateral line not interrupted, passing gradually from its row of scales posteriorly to the series next below it; tubes of lateral line much branched; scales about head large, those on cheek in a single row, those on median line in front of dorsal 3 or 4 in number.

Species of rather small size, most of them American; some of them showily colored.

SPARISOMA:
- *a*. Upper jaw with one or more canines above its cutting edge (these occasionally obsolete on one or both sides); coloration often brilliant.
  - *b*. Caudal truncate or slightly rounded, angles not acute.
    - *c*. Posterior canines 2 to 4 on each side.
      - *d*. Caudal fin with more or less of black on posterior margin, yellowish at base. Canines strong, 4 (rarely 3) on each side .... *xystrodon*, 189
      - *dd*. Caudal fin without black in adult; 1 or 2 more or less distinct whitish bars across chin.
        - *e*. Canines 3 or 4 on each side, radiating horizontally; axil with little or no blue, but with a dusky blotch partly hidden by fin; front steeper and less curved than in *S. hoplomystax;* body and fins mottled, but much less so than in *S. hoplomystax.*
          - *f*. Canines 3 on each side; pores of lateral line with but 2 branches; sides of head much dotted with black; caudal barred .... *atomarium*
          - *ff*. Canines 4 on each side; tubes of lateral line much branched; a distinct narrow streak of blue downward and forward from eye; caudal nearly plain dusky-olive; anal mottled .... *radians*
        - *ee*. Canines 2 or 3 on each side; axillary region extensively deep-blue in life, this forming a large blotch around and on base of pectoral; a curved series of small white specks around the blue on base of pectoral; fins all mottled, anal with 3 darker areas; body with 3 faint pale lengthwise streaks, more or less obscure, 2 of these bounding a more or less interrupted dusky band from eye to base of caudal .... *hoplomystax*, 190
    - *cc*. Posterior canine single on each side; body rather stout .... *niphobles*, 191

bb. Caudal fin simply lunate, outer rays more or less exserted, but not twice as long as inner rays and much shorter than head; canine single on each side (rarely obsolete or duplicated).

g. Head with a scarlet stripe from below eye to angle of mouth; a small scarlet streak behind eye; color, chiefly purplish brown; a round spot of yellow and black behind head, just below lateral line; fins chiefly red; angles of caudal black; axillary spot obscure .... *aurofrenatum*, 192

gg. Head without scarlet stripe.

h. Pectoral very long and sharp, 5 in body; body brownish, not striped; no axillary spot .... *oxybrachium*

hh. Pectoral moderate, less than one-fifth length.

i. Color, dark reddish-brown, with white mottlings; no yellow or black spot; belly abruptly red; fins mostly cherry red; axillary spot obsolete; body rather deep; scales large, their outlines well defined .... *abildgaardi*, 193

ii. Color, brownish, with 3 or 4 pale longitudinal streaks, upper running to a faint pale blotch on back of tail between 2 dark-brown blotches; caudal distinctly pale-edged behind and more distinctly barred than in *S. flavescens:* spot at base of pectoral brownish and very faint; about 4 small dusky blotches along base of dorsal, last one most distinct at base of last ray; caudal with many crossbars and blotches; snout dusky; chin with 1 or 2 whitish crossbars; caudal concave, with sharp angles; dorsal and anal mottled with brown; pectorals and ventrals plain; young with dark opercular blotch and dark points about eye .... *distinctum*

bbb. Caudal fin in adult deeply forked, upper lobe about as long as head and twice or more length of inner rays; caudal fin variegated.

j. Canines 4 to 6 on each side; pores of lateral line excessively branched, each with several (6 to 8) much divided branches. Color, bright greenish-blue (the sides sometimes with a blue band); caudal lobes blue, middle rays red; dorsal and anal red; pectoral yellowish, axillary spot large, black, edged with red ..... *chrysopterum*, 194

jj. Canines 1 or 2 on each side; upper and lower caudal lobes greenish.

k. Opercle without black-and-yellow spot; pores of lateral line each with 4 or 5 nearly simple branches....... *lorito*, 195

kk. Opercle with an inky-black spot, in front of which is a golden spot; no spot at base of pectoral .... *viride*, 196

EUSCARUS:

aa. Upper jaw never with posterior lateral canines; colors dull, usually mottled brown or greenish.

l. Caudal slightly rounded, angles not produced.

m. Scales of lateral line and some on nape and opercle black; dorsal spines stout; olive, vertical fins edged with violet; axil violet .... *strigatum*

ll. Caudle lunate, or truncate with sharp angles (rounded in very young).

n. Caudal fin distinctly barred with irregular brown spots and markings.

o. Body without distinct pale longitudinal streaks above; caudal not evidently pale-edged; spot on base of pectoral blackish and distinct; no evident pale or dark blotches on back of tail.

p. Caudal lunate or subtruncate in adult, rounded in young. General color olivaceous or reddish-brown, clouded, and washed with cherry-red; lower fins mostly red; pectoral light-orange; chin pale, with whitish crossband .... *flavescens*, 197

pp. Caudal truncate, not at all lunate in adult, angles very slightly produced.

q. Color olivaceous or bluish-green, a whitish streak below mouth; a dark axillary spot usually present; a whitish band on caudal; fins dotted .... *rubripinne*, 198

nn. Caudal fin not crossbarred.

r. Axillary spot black, very distinct; outer rays of caudal considerably produced, length of exserted part one-third to one-half that of head.

s. Caudal red, its outer rays green; axillary spot very distinct; body olivaceous, nearly plain-reddish below; some greenish-blue on head; a faint greenish streak running backward from angle of mouth .... *brachiale*, 199

ss. Caudal violaceous, its outer rays one-half head; a dark spot at base of pectoral; color dusky-red, scales of back and sides with red spots .... *maschalespilos*

rr. Axillary spot faint or wanting; coloration uniform dark purplish-violet; 3 large scales on cheek; dorsal spines rather slender, but pungent; caudal emarginate; tubes of each scale of lateral line much ramified and extending over whole scale; teeth of moderate size, very distinct on edges of jaws .... *frondosum*

189. **Sparisoma xystrodon** Jordan & Swain. *Loro; Parrot-fish.*

Head 3.2; depth 3; eye 5; snout 2.75; interorbital width 3.8; preorbital 3.2; scales 1-25-5; D. IX, 10; A. 11; pectoral 1.5; ventral 1.9; middle caudal rays 1.75. Body oblong wedge-shaped, heavy forward; profile in a regular curve from snout to dorsal fin; upper jaw with 3 or 4 exserted canines on each side above cutting edge, largest in front of angle of mouth curved outward and backward, one next in front less curved, directed downward and slightly forward (sometimes backward), the pair at median suture small; upper lip covering most of upper jaw. Scales large and thin, a row of five on cheek; 4 scales in front of origin of dorsal fin; dorsal low, spines pungent, longest shorter than snout, rays longer, about 2 in head; anal similar to soft dorsal but lower; caudal slightly convex when spread, outer rays slightly shorter than middle ones; pectoral broad, reaching a little past tips of ventrals; ventrals short, not reaching anus.

Color in life: Bright olive-green above, paler below, the upper parts very much mottled, speckled with white and marbled with coppery-red; head similarly green, dotted with whitish above; a narrow ring of bright blue below eye, interrupted above; a narrow blue stripe from eye to angle of mouth; a blue spot behind eye; blue and coppery markings on opercle; lower part of head light yellow, a blue band around margin of lower jaw; axil and a spot at base of pectoral in front above deep blue-black; dorsal orange flesh-color, the tip paler; caudal yellowish at the base, paler beyond, its posterior portion more or less black, a few whitish dots near base; anal light blue and reddish, the tip dusky; ventrals pale; pectoral light-yellowish; lining of opercle blackish; jaws pale. Some specimens are pearly-bluish rather than green above, livid below, blue on head paler, and the red of a light-yellowish carmine. Some highly colored specimens are greener, with belly bright yellow, brightest at throat; anal and caudal chiefly jet-black. (Jordan & Evermann, Key West specimens.)

Color in alcohol: Dark olive or grayish above, with slight green shade; lower parts paler; snout paler; blue line around eye and from eye to angle of mouth persistent; blue at base of pectoral usually changing to black; dorsal, anal, and caudal mottled; edge of anal and tip of caudal usually blackish.

This species can best be distinguished from *S. hoplomystax* and related species by the blue line about eye and from eye to snout, the dark edge of caudal fin, and the presence of 2 or 3 canines on each side of upper jaw. It is found in the West Indies and north to Key West, where it is very common in *Fucus* and eelgrass, along with *S. hoplomystax*. Length 4 to 7 inches. It is very common about Porto Rico, our collection containing specimens from San Juan, Aguadilla, Mayaguez, Puerto Real, Ensenada del Boqueron, Guanica, Ponce, Arroyo, Hucares, Fajardo, Culebra, Isabel Segunda, and San Geronimo. It was especially abundant at Ponce and Mayaguez.

Sparisoma xystrodon Jordan & Swain, Proc. U.S.N.M. 1884 (July 1, 1884), 99, Key West, Fla.; Jordan & Evermann, l. c., II, 1630, 1898.

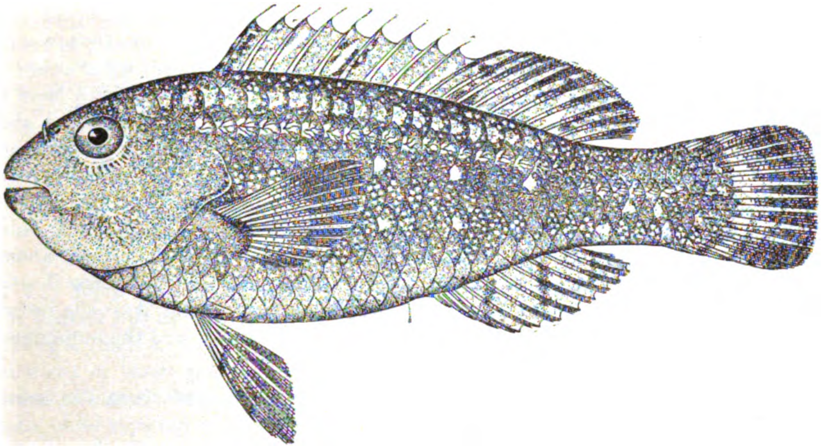

FIG. 67.—*Sparisoma hoplomystax.*

190. Sparisoma hoplomystax (Cope).

Head 3; depth 2.8; eye 3.5; snout 2.8; interorbital 3.7; preorbital 5.4; D. IX, 10; A. II, 9; pectoral 1.5; ventral 1.8; caudal 1.5; scales 1½–25–5. Body deep, the back considerably elevated; one strong posterior canine on each side of upper jaw, directed slightly backward, often a second canine in front of this and a small one directed downward on each side of front of upper jaw above the cutting edge and close to the median suture, these not evident in our specimen; caudal rounded.

Color in spirits: Grayish and olivaceous, caudal dark, with a few white mottlings and a narrow pale edge, the large scales at its base pale; dorsal and anal mottled with dark; side with about three longitudinal series of white spots smaller than pupil, one on row of scales above lateral line, another on row immediately below it, and the third two rows lower; about six spots in each row; some fainter and irregular white spots on side below.

This species ranges from Bahia through the West Indies north to Key West and Cape Florida; it has been recorded from Key West, St. Martins, and St. Lucia, but is apparently not common in Porto Rico. The collection contains but one individual, 2.75 inches long, from Mayaguez, of this type of coloration, and it seems to be identical with specimens identified as *Scarus radians* and *Sparisoma cyanolene* in the U. S. National Museum.

Labrus radians Castelnau, Anim. Nouv., etc., Amérique du Sud, 29, 1855; not *Scarus radians* Cuvier & Valenciennes.
Scarus radians Günther, Cat., IV, 211; Jordan & Gilbert, Synopsis, 906, 1883; not of Cuvier & Valenciennes.
Scarus hoplomystax Cope, Trans. Am. Philo. Soc. 1869, 462, St. Martins.
Sparisoma cyanolene Jordan & Swain, Proc. U. S. N. M. 1884, 98, Key West.
Sparisoma hoplomystax, Jordan & Evermann, l. c., 1632, 1898.

191. **Sparisoma niphobles** Jordan & Bollman. *Loro; Parrot-fish.*

Head 3; depth 2.67; eye 4.25; snout 3; D. ix, 10; A. ii, 9; scales 1–25–5. Body short and stout; snout short, obtuse; dorsal outline gently and regularly arched from tip of snout to origin of dorsal, thence in a regular descent to caudal peduncle; ventral outline less arched; a minute canine directed downward on front of upper jaw on each side close to median suture, and a larger, stronger lateral one, directed backward; lower jaw somewhat projecting, teeth coalesced except at tips; upper lip double for its entire length, covering most of upper jaw; cheek with one row of 5 large scales; lateral line complete, dropping from second to third row of scales under last dorsal rays, the tubes each with 3 to 5 branches; 4 scales on median line before dorsal. Origin of dorsal above base of pectoral, spines pungent, about equal to snout in length, rays a little longer; caudal slightly rounded, outer rays about 2 in head; anal similar to soft dorsal, its origin about under first dorsal ray; pectoral broad and short, about equal to snout and eye; ventral short, equal to snout and half eye.

Color in alcohol: Dirty gray, body mottled and speckled with whitish; an obscure whitish line, often not evident, from eye along lateral line to caudal, and a plainer, better-defined one from base of caudal to opercular flap, where it connects with a similar line from eye across opercle; in some specimens lower half of body abruptly paler, the dividing line running from lower edge of eye to the middle of caudal; base of pectoral and axil black, probably greenish in life; lower parts of side usually with more numerous white specks; under parts of the body paler; tip of lower jaw brown, followed by a white band, then another brown one, behind which is a series of 6 large white spots, middle ones largest, these spots sometimes confluent; subopercle and breast blotched with brown on bases of scales; dorsal with about 4 faint dark bars; anal similarly marked; caudal mottled, a pale line at tip. In life, grayish with washings of greenish and reddish; base of pectoral green.

This species is known only from the Bahamas, Cape Florida, Key West, and Porto Rico. It is quite abundant about Porto Rico, where numerous specimens were obtained from San Geronimo, Aguadilla, Mayaguez, Ensenada del Boqueron, Ponce, Hucares, and Fajardo. It was abundant at each of these places. Length 5 or 6 inches or less. Like most other species of this genus this fish frequents the patches of algæ in shallow water. From *S. hoplomystax* (Cope), which it closely resembles, it may best be distinguished by the presence of but a single lateral canine and the numerous small white specks, which are diagnostic.

Sparisoma niphobles Jordan & Bollman, Proc. U. S. N. M. 1888 (Sept. 20), 551, Green Turtle Cay, Bahamas; Jordan & Evermann, l. c., II, 1633, 1898.

192. **Sparisoma aurofrenatum** (Cuvier & Valenciennes).

Head 3.1; depth 3.1; eye 5; snout 2.6; interorbital 4.5; preorbital 4.6; D. ix, 10; A. ii, 9; pectoral 1.4; ventral 1.7; caudal 1.5; scales 1½–25–5. One posterior canine (obsolete or broken on right side in our specimen); caudal fin lunate, upper lobe very slightly longer than lower.

Color in life: Whitish green above, slightly rosy on side, greenish below; an orange splotch bordered at upper anterior edge by a black blotch just below lateral line under third dorsal spine; eye red; a brick-red bar from mouth under eye to opercle, above this 2 small oblong spots of same; rest of head bluish, teeth white, dorsal pale yellowish-red; anal rich red with bluish border; caudal olive at base, then a broad, rich blood-red bar or crescent, then a pale, whitish terminal crescent; outer rays clear red, tips of fin black; pectoral very pale-rosy, the anterior ray dark; ventral pale-rosy, a blue blotch at base of pectoral. In spirits, dark above, pale green on sides and below; a pale-yellow stripe from angle of mouth to below posterior margin of eye, bordered below by black; a short, narrow bar of same color behind eye; a distinct black blotch on fourth and fifth scales of lateral line, and a much larger blotch of yellow below the black; upper ray and base of pectoral dark, front of base black; anal with a dark line at base and a dark edge; angles of caudal inky-black, blotch on lower lobe the larger. Easily recognizable, even in spirits, by the characteristic persistent markings.

A West Indian species, known from Havana, Sombrero Key, Santo Domingo, Jamaica, Porto Rico, St. Thomas, and St. Lucia. One specimen, 7.5 inches long, obtained by us at Arroyo.

Scarus aurofrenatus Cuvier & Valenciennes, Hist. Nat. Poiss., XIV, 191, 1839, Santo Domingo.
Scarus mineofrenatus Poey, Memorias, II, 279, 1860, Cuba.
Sparisoma aurofrenatum, Jordan & Evermann, l. c., 1634, 1898.

193. **Sparisoma abildgaardi** (Bloch). "*Loro Colorado*"; *Red Parrot-fish.*

(PLATE 30.)

Head 3; depth 2.7; eye 6.4; snout 2.1; interorbital 4.5; preorbital 3.4; D. IX, 10; A. II, 9; pectoral 1.3; ventral 1.6; caudal 1.3; scales 2–25–5. Dorsal and ventral outlines of body alike, snout without fleshy hump; caudal fin lunate, lobes equal; a single canine on each side of upper jaw above cutting edge (in one small specimen 2 on right side).

Color in life: Fins and lower parts below a line from tip of under jaw to base of caudal under the end of lateral line, red, edges of scales paler; body above grayish, edges of scales black, bases of those below lateral line rosy; brownish-red wavy stripes radiating from eye below; oblique pale-blue stripes on dorsal, tips of row of smaller scales at base of anal blue, and 3 blotches on upper and 3 on lower ray of caudal; a few scales at base of caudal with pale yellow; iris yellow, pupil bordered narrowly with red; membranous edge of opercle black.

This gorgeously colored parrot-fish is generally common from Cuba south to Brazil and has been recorded also from Martinique, Jamaica, Santo Domingo, and Havana. The collection from Porto Rico contains 2 specimens, 11 and 12.5 inches long, respectively, from Arroyo, where many others were seen. While it was not noticed elsewhere it is probably not rare about the island.

Vieja, Parra, Descr. Dif. Piezas, Hist. Nat., 58, pl. 28, fig. 2, 1787, Cuba.
Scarus abildgaardi Bloch, Ichth., pl. 259, 1791, America; from a specimen sent by Professor Abildgaard.
Scarus coccineus Bloch & Schneider, Syst. Ichth., 289, 1801, Cuba; after Parra.
Scarus aureoruber Lacépède, Hist. Nat. Poiss., IV, 55, 163, 1803, Martinique; on a drawing by Plumier.
Scarus amplus Ranzani, Nov. Comm. Ac. Sci. Inst. Bonon., 324, taf. 5, pl. 25, 1842, Brazil (fide Guichenot; not seen by us).
Scarus erythrinoides Guichenot, Scarides Mus. Paris, 10, 1865, Santo Domingo.
Scarus oxybrachius Poey, Synopsis, 342, 1868, Cuba.
Sparisoma abildgaardi, Jordan & Evermann, l. c., 1635, 1898.

194. **Sparisoma chrysopterum** (Bloch & Schneider).

"Loro Verde"; "Cotoro Verde"; Vieja; Blue Parrot-fish.

Head 3.1; depth 3; eye 5.8; snout 2.1; interorbital 5.5; preorbital 3.2; D. IX, 10; A. II, 9; pectoral 1.5; ventral 1.9; caudal 1.2; scales 1¼–25–5. Dorsal and ventral outlines nearly alike, dorsal somewhat more strongly arched; 4 to 6 strong canines on each side of upper jaw, those behind usually pointing outward or backward, those in front forward, sometimes one or two small ones at suture; pores of lateral line much branched, more so than in any other known Porto Rican species; caudal deeply lunate, outer rays much produced, upper lobe the longer, twice length of middle rays. Known from the other species by the canines, produced rays of the caudal, and the blue color.

Color in life: Rich greenish-blue or bluish-green above; edges of scales greener, their bases darker; under parts rich blue; head greenish-blue, somewhat mottled; lower jaw and breast sky-blue; dorsal pale rose; anal pale blue at base, then broadly pale brick-red, then a very narrow pale-blue border; caudal reddish at base, blue on outer rays extending to tips; abaft the red a pale crescent, then a broad blood-red one, and last a narrow bluish-green border; pectoral pale lemon, a black splotch at base above; ventral pale-greenish.

In spirits, body nearly everywhere a faded-blue, brighter on head and under pectoral; dorsal and pectoral pale; ventral chiefly pale, with traces of blue; anal soiled-grayish; middle of caudal pale, its edge dark, outer rays greenish; a black blotch on base of pectoral above.

This species is generally common from the West Indies to Brazil, and is known from Havana. Santo Domingo, Jamaica, Porto Rico, Martinique, St. Thomas, St. Croix, St. Kitts, Guadeloupe, and Bahia. It reaches a good size and is of some value as a food-fish. Two fine specimens, each a foot long, were obtained from Arroyo and Isabel Segunda, and others were seen at each of these places and at Culebra.

Vieja, Parra, Descr. Dif. Piezas, Hist. Nat., 58, pl. 28, fig. 4, 1787, Cuba.
Scarus chrysopterus Bloch & Schneider, Syst. Ichth., 286, pl. 57, 1801, American seas.
Scarus chloris Bloch & Schneider, Syst. Ichth., 289, 1801, Cuba; after Parra.
Scarus lateralis Poey, Memorias, II, 219, 1860, Cuba.
?*Scarus spinidens* Guichenot, Scarides, 15, 1865, Bahia.
Sparisoma chrysopterum, Jordan & Evermann, l. c., 1636, 1898.

195. Sparisoma lorito Jordan & Swain. "*Loro*"; *Parrot-fish.*

Head 3; depth 2.9; eye 5.3; snout 2.3; interorbital 5.2; preorbital 3.5; D. IX, 10; A. II, 9; pectoral 1.5; ventral 1.8; caudal 1.3; scales 1½-25-5. Back moderately elevated, dorsal outline much more strongly arched than ventral; eye high in position; one posterior canine on each side of upper jaw, and one or more small ones near suture; caudal deeply lunate, upper lobe very slightly the longer.

Color in spirits: Uniform greenish; a very distinct deep-black blotch on base of upper rays of pectoral; outer rays of caudal darker than middle. Much resembling *S. brachiale* in spirits, but differing in the presence of canine teeth.

A West Indian species, known from Havana, Haiti, Jamaica, Porto Rico, Sombrero, and Barbados. Two specimens, each about 10 inches long, were obtained by us—one at Puerto Real, the other at Arroyo—and others were seen. It is of some value as a food-fish.

Sparisoma lorito Jordan & Swain, Proc. U. S. N. M. 1884 (July 1), 95, Havana; Jordan & Evermann, l. c., 1637, 1898.

196. Sparisoma viride (Bonnaterre). "*Loro Verde*"; "*Coloro*"; *Dark-green Parrot-fish.*

Head 3; depth 2.6; eye 7.5; snout 2; interorbital 4; preorbital 3.1; D. IX, 10; A. II, 9; pectoral 1.4; ventral 1.7; caudal 1.3; scales 2-25-5. Body rather deep, back elevated, profile nearly straight from snout to dorsal; caudal deeply lunate, outer rays considerably produced, upper lobe slightly the longer; 2 canines on each side of upper jaw.

Color in life: Rich bluish-green, edges of scales as well as their bases brownish; top of head light clear brown down to level of pupil, this brown patch extending from occiput to near tip of snout, which is green with a narrow brown border; a narrow brown bar backward from eye to humeral region, and a similar one from mouth backward to opercle, this connecting with the narrow line around each lip; space above this rich green, below paler green; upper edge of opercle with a small pale-lemon spot, below it a green one, then rest of opercle with a broad reddish-orange border; subopercle with a very narrow orange border; caudal peduncle with a large irregular orange blotch covering about 5 or 6 scales; dorsal pale-reddish, the sheathing scales at base very rich green; caudal dark green at base and on outer rays nearly to tips; next a crescent of rich orange, the horns extending to tips; lastly a broad crescent of paler green or bluish green; anal green at base, then a broad rich orange band, then a broad blue border; pectoral green on upper and lower rays, paler between; ventral rich blue-green on outer ray, rest pale-orange; teeth white, with slight bluish tinge.

In spirits: Pale-greenish, top of head grayish-brown, a band of same color behind eye; side of head blue, abruptly demarcated from color of top of head; a pale band from angle of mouth across cheek, then narrowing and curving upward across opercle; lips blue, their edges pale; membranous edge of opercle pale, a bright-yellow spot above; anal with blue margin and base, pale in middle; caudal with blue margin, widening on middle rays, a yellow crescent-shaped band in front of it, rest of fin greenish; pectoral bluish above and in front, pale-yellowish below and behind; scales at base of caudal pale yellow.

A West Indian species; known from the Bahamas, Sombrero Key, Jamaica, Porto Rico, St. Thomas, and St. Croix. Obtained by us at Arroyo and Culebra, where it is probably common. It attains a length of 2 feet or more and, though used for food, it is not of much value.

Piscis viridis bahamensis (the Parrot-fish), Catesby, Nat. Hist. Carolinas, etc., II, 29, pl. 29, 1738, Bahamas.
Scarus viridis Bonnaterre, Enc. Méth., X, 96, 1788, Bahamas; after Catesby.
Scarus catesby Lacépède, Hist. Nat. Poiss., IV, 16, 1803, Bahamas; after Catesby.
Scarus catesbæi Cuvier & Valenciennes, Hist. Nat. Poiss., XIV, 183, 1839, Bahamas.
Scarus melanotis Bleeker, Ichth. Notizen, I-X, 4, 1862, St. Croix.
Sparisoma viride, Jordan & Evermann, l. c., 1638, 1898.

197. Sparisoma flavescens (Bloch & Schneider). *Vieja Colorada; Mud Parrot-fish.*

Head 3.1; depth 2.7; eye 5.5; snout 2.4; interorbital 4; preorbital 4; D. IX, 10; A. II, 9; scales 1-25-5. Body rather stout, compressed, heavy forward; profile evenly curved from tip of snout to dorsal fin, then in a long regular slope to caudal peduncle; mouth normal, gape not reaching eye by a distance greater than half diameter of orbit; jaws pale, lower jaw projecting; no canines; upper lip covering all of upper jaw; scales large and thin, a single row of 5 scales on cheek, 4 scales before origin of dorsal; tubes of lateral line dividing into 4 or 5 branches, covering most of scale; top of head with numerous small papillæ, forming elevated lines posteriorly and behind eye; origin of dorsal over base of pectoral; longest dorsal spine about 2.5 in head; dorsal rays slightly longer; anal similar to soft dorsal; pectoral rather long, reaching past tips of ventrals, rays about 1.4 in head; ventrals about 1.7 in head; caudal fin usually lunate, lobes pointed and projecting, especially in adult; in the young the fin is sometimes merely truncate, never rounded as in *S. rubripinne.*

Color of adult in life: Olivaceous, clouded with light and dark, and usually flushed with pinkish, especially below, edges of the scales more yellow-olive; scales of belly and lower parts light orange-red toward their bases, giving a decidedly reddish cast; dorsal mottled with different shades of olive; caudal creamy, mottled and barred with darker orange, markings more distinct on outer edge; ventrals and anal rich cherry-red, mottled and barred with brown; pectoral light orange-red, color formed by narrow orange cross-streaks on a paler ground; a light band across lower jaw, which is otherwise brown; a dusky or black blotch at base of pectoral; blackish blotches sometimes present on body at base of soft dorsal. In alcohol, the red and yellow fade and become pale and the general color is brownish, paler below; usually a dark blotch at base of soft dorsal and one on base of pectoral.

S. flavescens is close to *S. rubripinne*, from which it can be distinguished most readily by the difference in shape of caudal fin and its lighter coloration. In *S. rubripinne* the caudal is more or less rounded, while in *S. flavescens* it is lunate or truncate, tips of lobes always being pointed.

The range of this species extends from Biscayne Bay and Key West southward to Rio Janeiro. It is generally common, and is known from Cape Florida, Key West, Havana, Bahamas, Tortugas, St. Thomas, Jeremie, Haiti, Port au Prince, Jamaica, Porto Rico, St. Lucia, and Rio Janeiro. It is abundant in Porto Rico. The collection contains specimens from the following localities: San Juan, Mayaguez, Puerto Real, Guanica, Ponce, Ensenada del Boqueron, Hucares, Fajardo, Isabel Segunda, and Culebra Island. It rarely exceeds a foot in length. It is very abundant at Key West, swarming everywhere about the island in the eelgrass. At Havana it is apparently equally common, the numbers seen in the market exceeding that of all other species of the genus combined. Its flesh, although not unpleasant in flavor, is soft and rather poor. In the Havana market it is usually called *Vieja Colorada*, but the species of this group are seldom distinguished by the fishermen.

Vieja, Parra, Descr. Piezas Dif. Hist. Nat., 59, pl. 28, fig. 4, 1787, Cuba.
Scarus flavescens Bloch & Schneider, Syst. Ichth., 290, 1801, Cuba; after Parra.
Scarus squalidus Poey, Memorias, II, 218. 1860, Cuba,
Sparisoma flavescens, Jordan & Evermann, l. c., 1640, 1898.

198. **Sparisoma rubripinne** (Cuvier & Valenciennes). *Vieja; Loro; Parrot-fish.*

Head 3.3; depth 2.9; eye 5.5; snout 2.5; interorbital 3.7; preorbital 4; D. IX, 10; A. II, 9; scales 1-25-5. Body stout, compressed; head large, somewhat rugose in the adult; mouth small, gape not reaching vertical of eye by a distance equal to half of its diameter; lower jaw projecting; no canines; suborbital with venules; pores of lateral line with 3 or 4 branches; 4 scales in front of dorsal. Fins moderate; dorsal spines pungent, longest about equal to snout; dorsal rays a little longer, about equal to those of anal; pectoral long, 1.3 in head; ventral shorter, about 1.9 in head; caudal truncate in adult, usually rounded in young, never lunate as in *S. flavescens*, outer rays about equal to snout and eye.

Color in life (a specimen 9 inches long): Head and side dirty mottled-brown; 3 brown bars on lower jaw; fins all mottled-brown and yellowish; belly white. Another specimen, 4 inches long, from San Juan, had the sides bluish-olivaceous; edges of scales darkest; white on belly; side of head with 2 irregular brownish bars; tip of lower jaw brownish, followed by a white stripe, then a broad brown bar followed by white; dorsal pale, mottled with brown, especially near base; caudal crossed by alternating bars of brown and paler; irregular brown blotches at base of caudal; anal rosy, blotched with brown; pectoral pale; ventrals pale-rosy, inner rays white; jaws white. Another specimen, 4 inches long, from Aguadilla, was described as grayish, paler below; chin with 2 broad brown bands; 4 black blotches on back, first on and at base of first dorsal spine, second on base of sixth and seventh rays, third on about eleventh and twelfth rays, and fourth on last ray but one, all these extending somewhat on sides; iris green, rest of eye silvery and brownish; dorsal and anal fins mottled reddish-brown; caudal brown, with 2 or 3 irregular cross-series of pale spots; ventrals reddish; pectoral pale. In alcohol, general color grayish-brown, paler below; head brown; chin with 2 or 3 broad brown bands separated by white ones; base of pectoral dark; a dark blotch on body at edge of opercle; 4 rather distinct dark blotches on back extending upon dorsal fin, which is mottled with dark and light; caudal dark, with 2 irregular cross-rows of white spots, more or less confluent in anterior row; extreme tip of tail with a pale border; anal barred and mottled like dorsal; pectoral and ventral pale; jaws pale.

A West Indian species (length 6 to 9 inches) closely resembling *S. flavescens*, from which it can best be distinguished by its rounded (or rarely truncate) caudal, and absence of whitish or snowy blotches on sides. It is known from Santo Domingo, Porto Rico, Jamaica, and Martinique. It is common about Porto Rico, the collection containing specimens from San Juan, Aguadilla, Mayaguez, Ensenada del Boqueron, Puerto Real, Guanica, Ponce, Arroyo, Hucares, and Fajardo.

Scarus rubripinnis Cuvier & Valenciennes, Hist. Nat. Poiss., XIV, 199, 1839, Santo Domingo.
Scarus virens Cuv. & Val., Hist. Nat. Poiss., XIV, 203, 1839, Porto Rico (Coll. Plée), and Martinique (Coll. Achard).
Scarus circumnotatus Poey, Memorias, II, 423, 1861, Havana.
Scarus truncatus Poey, Synopsis, 339, 1868, Havana; Poey, Fauna Puerto-Riqueña, 336, 1881; Stahl, l. c., 78 and 164, 1883.
? *Scarus emarginatum* Poey, Synopsis, 340, 1868, Havana.
Sparisoma rubripinne, Jordan & Evermann, l. c., 1640, 1898.

199. **Sparisoma brachiale** (Poey).

Head 3.2; depth 3.1; eye 5.6; snout 2.2; interorbital 5.3; preorbital 3.4; D. ix, 10; A. ii, 9; pectoral 1.4; ventral 1.7; caudal 1.3; scales 1½–25–5. Body elongate, back moderately elevated, dorsal and ventral outlines much alike; eye about midway between tip of snout and end of opercle, very high in position; no canines; outer rays of caudal considerably produced, making fin rather strongly lunate, middle part truncate or slightly convex; lateral line interrupted near end of dorsal, beginning again on row below, the two ends usually overlapping.

Color in life: Rich red above, paler below, edges of scales white; fins all rosy-red; teeth white. In spirits, very pale greenish, dark olive in one specimen; in some cases with rosy flushes on side; a large jet-black spot at base of upper rays of pectoral, not extending into axil; no other distinct markings.

A West Indian species known only from Cuba, Jamaica, and Porto Rico. Seen by us at Aguadilla, Arroyo, and Isabel Segunda, where specimens 9 to 12.5 inches long were obtained; also collected by Mr. Gray at San Geronimo.

Scarus brachialis Poey, Memorias, II, 345, 1861, Cuba.
Scarus humeralis Poey, Memorias, II, 422, 1861, Havana; based on an old drawing; a black axillary spot, sown with white points.
Sparisoma brachiale, Jordan & Evermann, l. c., 1641, 1898.

Genus 110. SCARUS Forskål. Loros; Parrot-fishes.

Lower pharyngeals spoon-shaped, ovate-oblong, transversely concave; teeth in each jaw fully coalescent, appearing as tessellations on the surface; jaws with distinct median sutures; edges of jaw even, teeth whitish or rosy in color, never green. Upper pharyngeals each with 2 rows of teeth; gill-membranes scarcely united to the narrow isthmus, across which they form a broad fold; dorsal spines flexible, scarcely different from soft rays; upper lip laterally double, interior fold becoming very narrow or obsolete mesially; lower jaw included in the closed mouth; lateral line interrupted posteriorly, commencing again on next series of scales below; tubes of lateral line scarcely branched; scales on cheek in 2 to 4 rows; scales in front of dorsal on median line 6 to 8. D. ix, 10; A. ii, 9 in all species; scales 2½–24–6. Body robust.

Scarus:
- *a.* Upper jaw with from 1 to 4 posterior canines.
  - *b.* Cheek with 2 or 3 rows of scales.
    - *c.* Head with a longitudinal band; a yellow longitudinal stripe on body; outer rays of caudal not colored like inner; caudal subtruncate.
      - *d.* Outer rays of caudal blackish or greenish, darker than median rays.
        - *e.* Yellow stripe above pectoral about on a level with eye; outer rays of caudal deep greenish-blue; upper jaw with 1 posterior canine (rarely duplicated); 2.5 rows of scales on cheek; head with 2 bluish-green stripes, interspace reddish or yellow; dorsal and anal each with 2 green bands and 1 orange one, anal having a roundish blue spot on membrane between every 2 rays. General color bluish-green mixed with orange............... *punctulatus*
        - *ee.* Yellow stripe above pectoral, mostly below level of eye; outer rays of caudal blackish, rest of caudal green; upper jaw with 2 posterior canines; 2 rows of scales on cheek, upper part of head dark-green, below eye bright yellowish-green, with bluish markings on opercle; dorsal bright-green at base; ventrals pale; base of pectoral with a blue-black mark. General color in life, bright-green; darker on back, paler below........... *bollmani*
      - *dd.* Outer rays of caudal orange, lighter than median rays, its edge blackish; yellow stripe above pectoral, below level of green stripes on head, which are nearly horizontal; upper jaw with 1 posterior canine (rarely duplicated); 2.5 rows of scales on cheek; head with 2 bluish-green stripes, interspaces reddish or yellow; dorsal and anal each with 2 green bands and 1 orange one, the latter without blue spots; basal band of dorsal not broken into green spots. General color bluish-green, mixed with orange.. *tæniopterus*
    - *cc.* Head without longitudinal bands; posterior canines 2 to 4.

f. Caudal truncate; 2 series of scales on cheek, and 2 scales on lower preopercular limb; canines 2 or 3 on each side. Color uniform violet-purple; vertical fins very dark .... *aracanga*

ff. Caudal fin lunate, the outer rays more or less produced; cheek with 2.5 or 3 rows of scales; posterior canines 3 or 4; color (dried skin) plain brownish, caudal in one specimen darker, or paler mesially, its border and angles dark .... *trispinosus*

bb. Cheek with 4 rows of scales; angles of caudal more or less salient.

g. Color dusky-olivaceous, some scales with a rosy blotch at base; dorsal edged with dusky; caudal dark, pale at base, and with pale shades, its angles little produced; opercle with blue blotches; canines 3; snout rather acute; 7 scales before dorsal .... *cuzamilæ*

gg. Color, dark sky-blue; jaws with bright colors .... *vetula*, 200

ggg. Color brown, with 2 brown lateral bands .... *gnathodus*

aa. Upper jaw without canines; 2.5 series of scales on cheek.

h. Third (partial) row of scales of cheek of 3 or 4 scales, those of upper row little larger than those of second row.

i. Caudal slightly rounded, its outer rays not produced.

j. Side of body with 2 broad, dark longitudinal shades; sides of belly each with 3 sharply defined lines, each on a row of scales, these stripes running from breast to beyond front of ventrals and usually becoming faint or even obsolete in old individuals.

k. Stripes on side of breast, if present, whitish. Color dark reddish-brown above, paler below; back dark; side with 2 dark parallel stripes of color of back, separated by paler interspaces, upper one extending backward from eye; snout above bluish-brown; a narrow whitish streak running from head along middle line of belly; a faint dark spot on base of pectoral; caudal pale orange-red, outer rays somewhat barred with brown; dorsal orange, edged with bluish; other fins nearly plain .... *croicensis*, 201

kk. Stripes on side of breast, if present, inky-blue. Color bright-green, olivaceous above, paler below, lower half of body becoming posteriorly more and more yellow, and on lower half of caudal peduncle bright light-yellow, this color being brightest above front of anal; longitudinal shades on side of body bright crimson, separated on head by a band of green; no spot on base of pectoral; caudal fin green, its lower half yellow; dorsal, anal, and pectoral green, at least at base; ventrals yellow .... *evermanni*

jj. Sides of body without distinct, broad, darker stripes. Color brown; no bands or lines upon body or head; dorsal spotted with violet and edged above and below with yellow, like caudal; caudal without spots; yellow line near edge and another along base of dorsal .... *flavomarginatus*

ii. Caudal truncate, its points slightly salient; side with a broad whitish band .... *acutus*

hh. Third (partial) row of scales on cheek of 1 or 2 scales only; scales of upper row much larger than those of second row; caudal subtruncate, its outer rays more or less produced, becoming much elongate with age; adult with a fleshy hump above snout.

l. Color bright-blue, young more or less shaded with reddish-brown; fins mostly blue. Size large .... *cæruleus*, 202

ll. Color dusky-olive; a pale-yellowish streak from upper part of eye to upper base of caudal .... *emblematicus*

200. Scarus vetula Bloch & Schneider. *Mud-fish; Vieja; Old Wife.*

(PLATE 31.)

Head 2.7; depth 2.7; eye 7; snout 2.3; interorbital 2.8; preorbital 4.2; D. IX, 10; A. II, 9; pectoral 1.5; ventral 2; caudal 1.3; scales 2–25–6. Dorsal and ventral outlines alike, head pointed; 2 posterior lateral canines in upper jaw; caudal margin slightly concave between outer produced rays.

Color in life: Scales of trunk bluish-green, their edges pink; head variegated, the ground-color in shades of grayish, pink, and blue; a wavy green stripe from slightly below angle of mouth obliquely upward to below posterior margin of eye, bordered on both sides with yellow; a similar shorter stripe on snout, similarly bordered; a bent green bar before eye and a very short one behind; lower lip and chin blue; iris yellow; outer half of dorsal fin abruptly green, the line of demarcation curving obliquely upward from base of first spine, thence nearly straight to tip of ninth ray; yellow below the green, shading into rosy on base of fin, which has oblique pale-blue bars, one near base of each interradial membrane, below which is an oblong deep-blue blotch; anal colored exactly like dorsal, but without oblique pale-blue bars; pectoral with its upper edge blue, below which is a band of pink spreading out over the base, rest of fin light-green; ventral with spine and first ray blue, second yellow, the rest pale, with rosy membranes; caudal with upper and lower produced rays blue, the two inner of the produced rays rosy at base, yellowish at ends, rest of fin green; several scales at base of caudal rosy.

This is one of the most gaudy of the parrot-fishes, the combination of colors being very extraordinary. It is thus far known only from Cuba and Porto Rico, where it is not uncommon. The specimen in our collection from which the colored drawing (plate 31) was made is 12.5 inches long and was obtained at Puerto Real. We have compared it with a specimen in the National Museum which has been identified with Poey's *S. superbus* and find that they agree perfectly. The identity of *S. superbus* with *S. vetula* seems certain, though there are some slight discrepancies in the descriptions.

Vieja, Parra, Descr. Dif. Piezas, Hist. Nat., 58, pl. 28, fig. 1, 1787, Havana.
Scarus vetula Bloch & Schneider, Syst. Ichth., 289, 1801, Cuba; after Parra; Jordan & Evermann, l. c., 1649, 1898.
Scarus superbus Poey, Memorias, II, 218, 1860, Cuba.

201. **Scarus croicensis** (Bloch). *Bullon.*

Head 2.9; depth 3.3; eye 4.8; snout 2.9; interorbital 3; preorbital 4.8; D. IX, 10; A. II, 9; pectoral 1.6; ventral 2; caudal 1.9; scales 1½-25-6. Body elongate, little elevated, dorsal and ventral outlines alike, jaws without canines; caudal fin slightly rounded.

Color in life: Brownish above, pale below; a broad band of brown from eye to base of caudal, a narrower one below this from base of pectoral to caudal; a pale-bluish line bordering upper band above and below; two or three white or pale-bluish longitudinal streaks on sides of abdomen.

A species of small size but great abundance, from southern Florida and the West Indies; known from Key West, the Tortugas, Bermuda, Havana, Porto Rico, St. Thomas, Jamaica, St. Lucia, Martinique, and St. Croix. Numerous specimens obtained by us at San Antonio Bridge, Boqueron, Mayaguez, Hucares, Fajardo, and Culebra; 8 by Mr. Gray at San Geronimo. It probably does not exceed 5 or 6 inches in length.

Scarus croicensis Bloch, Ichth., pl. 221, 1790, St. Croix; Jordan & Evermann, l. c., 1650, 1898.
Scarus insulæ-sanctæ-crucis Bloch & Schneider, Syst. Ichth., 312, pl. 62, fig. 2, 1801; after Gronow.
Scarus alternans Cuvier & Valenciennes, Hist. Nat. Poiss, IV, 200, 1839, Martinique.
Pseudoscarus lineolatus Poey, Repertorio, II, 239, 1868, Cuba.

202. **Scarus cœruleus** (Bloch). *"Loro"; Blue Parrot-fish; "Tumble-nose."*

(PLATE 32.)

Head 3; depth 3; eye 8; snout 2.3; interorbital 2.8; preorbital 3.7; D. IX, 10; A. II, 9; pectoral 1.6; ventral 1.8; caudal 1; scales 2-25-6. Body elongate, back scarcely elevated, but snout with a large fleshy hump so that head is not pointed, hump much more prominent in old individuals; anterior profile strongly concave above eye in a specimen 20 inches long, nearly straight or slightly convex in one of 14 inches; eye small; caudal truncate or slightly rounded between the produced outer rays; no canines; pores of lateral line little branched.

Color in life: Everywhere uniform turquoise-blue, bases of vertical fins much deeper blue; iris blue, pupil with a narrow brownish-yellow border; a brownish-yellow stripe bordering lower jaw; faint wine-colored shades on side of head below and behind eye; head, back, belly, and tips of fins greenish-blue.

The blue parrot-fish reaches a length of 2 or 3 feet and a weight of 12 to 20 pounds. It has the widest distribution of any member of the family, being found from Chesapeake Bay southward to Florida and throughout the West Indies. It has been recorded from St. George Island (Maryland), Cape Charles, Bahamas, Key West, Tortugas, Havana, Martinique, Jamaica, and Porto Rico. Two specimens, 14.5 and 20 inches long, were obtained by us at Culebra Island, and many others were seen in the boats of the St. Thomas, St. Croix, and Tortola fishermen who frequent the waters about Culebra and Vieques islands. Though evidently not held in high esteem, it is doubtless the most important food species of the parrot-fishes occurring about Porto Rico, due chiefly to its abundance and large size, and the catch seems to be always saved by the fishermen.

So far as known, none of the parrot-fishes ever takes the hook, and they are therefore usually caught in some sort of trap. The trap in common use about Porto Rico is shown on page 31. About Culebra Island these traps or baskets are set in 5 to 8 fathoms of water, and are usually baited with large chunks of cactus pulp, made white by trimming off the green outer part.

These large parrot-fish are taken in considerable numbers, along with hog-fish, doctor-fish (medicos), groupers, snappers, and grunts. The name "tumble-nose" is given by fishermen to unusually large blue parrot-fish, on account of the peculiar topography of the nose.

Novacula cærulea (the Blue-fish), Catesby, Nat. Hist. Carolina, etc., 18, pl. 18, 1743, Bahamas.
Loro, Parra, Descr. Dif. Piezas, Hist. Nat., 57, pl. 27, fig. 1, 1787, Cuba.
Trompa, Parra, l. c., fig. 2.
Coryphæna cærulea Bloch, Ausländische Fische, II, 120, pl. 176, 1786, in part, Bahamas; after Catesby and a figure by Aubriet, altered from a figure by Plumier.
Scarus loro Bloch & Schneider, Systema Ichthyol., 288, 1801; after *Loro* of Parra.
Scarus trilobatus Lacépède, Hist. Nat. Poiss., IV, 21, 1803, Martinique; on a drawing by Plumier.
? *Scarus holocyaneos* Lacépède, Hist. Nat. Poiss., IV, 45, 1803, Martinique; on a copy by Aubriet of a drawing by Plumier; the copy colored entirely blue in order to represent this species; the original drawing probably intended for *Sparisoma chrysopterum;* the same copy by Aubriet, the original of Bloch's engraving of *Scarus cæruleus.*
Scarus obtusus Poey, Memorias, II, 217, 1860, Cuba; adult.
Scarus nuchalis Poey, Memorias, II, 220, 1860, Cuba; young.
Scarus cæruleus, Jordan & Evermann, l. c., 1652, 1898.

Genus 111. PSEUDOSCARUS Bleeker. Guacamaias.

This genus differs from *Scarus*, as here understood, chiefly in the deep green or blue color of its highly modified jaws and teeth. The species are mostly of large size and robust form. Five species of this genus are recognized by Jordan & Evermann as occurring in American waters north of Panama, only one of which is thus far known from Porto Rico.

PSEUDOSCARUS:
- *a.* Upper jaw with canines; caudal fin with angles much exserted, especially in adult; soft dorsal and anal ending in points; 2.5 rows of scales on cheek.
  - *b.* Upper jaw usually with 1 posterior canine. Color bright-blue, edges of scales brownish; fins dark-brown, with green upon external border of ventrals, which are long and pointed; forehead with a fleshy hump in adult.
    - *c.* Tubes of lateral line considerably branched .... *cœlestinus*
    - *cc.* Tubes of lateral line not branched .... *simplex*
  - *bb.* Upper jaw with from 3 to 6 posterior canines; jaws very convex. Color green under pectoral and along side and posterior part of body; head, anterior and upper part of back, and belly grayish-yellow; dorsal and anal brown, spotted with green along their bases; pectorals and ventrals tinted with green; caudal grayish-yellow. Size large .... *pleianus*

LORO:
- *aa.* Upper jaw without posterior canines; teeth deep blue-green. Size large.
  - *d.* Caudal deeply notched, angles much produced in adult (fin truncate or rounded in young); body moderately elongate; depth 2.5 to 3 in length; cheek with 2.5 rows of scales, those of upper row larger than those of second, 1 scale below second row. Color olive-green, with more or less ill-defined green markings on head; lower parts more or less reddish; vertical fins brownish-orange, all edged with deep-blue .... *guacamaia*, 203

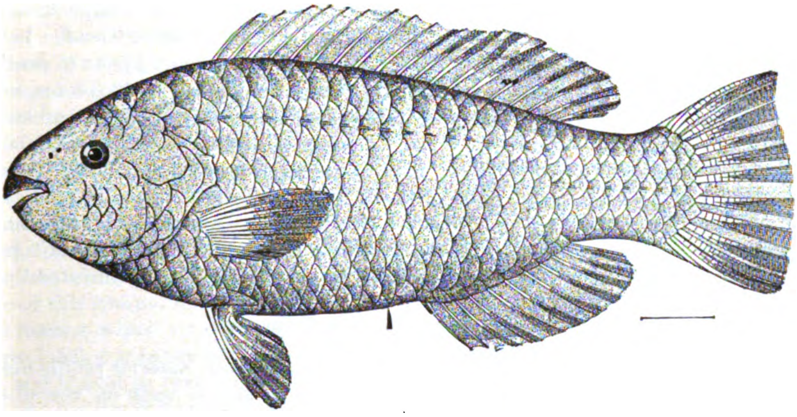

FIG. 68.—*Pseudoscarus guacamaia.*

203. Pseudoscarus guacamaia (Cuvier). *Guacamaia; Green Parrot-fish.*

Head 2.9; depth 2.7; eye 5; snout 2.8; interorbital 3; preorbital 5.5; D. IX, 10; A. II, 9; pectoral 1.5; ventral 1.9; caudal 1.5; scales 1½–25–6. No canine teeth; lower jaw included in closed mouth; lateral line interrupted under last dorsal rays, beginning again two rows lower, its pores scarcely branched; caudal slightly rounded.

Color in life: Sides mottled blue and brown or with blue bars separated by irregular brown ones; under parts white, with numerous fine dark punctulations; head with a narrow pale greenish-blue bar under eye, extending upon lower jaw and fading to white, uniting with its fellow on chin; a short preocular blue bar; teeth green; dorsal and anal brick-reddish, with narrow blue border; a few indistinct bluish spots along base and through middle of fin; base of anal with pale-blue spots; caudal dirty-red with darkish border; ventral pale-rosy, anterior edge blue; pectoral pale. In spirits: Pale-greenish, darker above; teeth greenish-blue; the green stripes on head sometimes persisting; vertical fins dark-edged.

This species is known at once by the absence of canines and the blue teeth. It ranges from Florida south to Rio Janeiro; it has been recorded from St. Augustine, Key West, Havana, and Porto Rico. Numerous specimens, all young, from 1.75 to 5.88 inches long, were seined at San Antonio Bridge, Puerto Real, Boqueron, Culebra, and Fajardo. It is probably one of the most abundant of the large parrot-fishes about Porto Rico, as it is also about Key West. It is not uncommon at Havana, where it is still known as "guacamaia," the name by which it was known to Parra more than a century ago. It reaches a length of 2 feet or more, and is of some value as food.

Guacamaia, Parra, Descr. Dif. Piezas, Hist. Nat., 54, pl. 26, 1787, Cuba.
Scarus guacamaia Cuvier, Règne Animal, ed. II, vol. 2, 265, 1829, Cuba; after Parra.
Scarus turchesius Cuvier & Valenciennes, Hist. Nat. Poiss., XIV, 181, 1839, Porto Rico.
Scarus rostratus Poey, Memorias, II, 221, 1860, Havana.
Pseudoscarus turchesius, Poey, Fauna Puerto-Riqueña, 337, 1881: Stahl, l. c., 78 and 164, 1883.
Pseudoscarus guacamaia, Jordan & Evermann, l. c., 1657, 1898.

FAMILY LIII. EPHIPPIDÆ. The Spade-Fishes.

Body compressed, usually greatly elevated, anterior profile steep, caudal peduncle short. Scales moderate or small, ctenoid, densely covering soft parts of vertical fins; lateral line present, following curve of back. Mouth small, terminal, horizontal; premaxillaries slightly protractile; maxillary short, without supplemental bone, partly slipping under the narrow preorbital; jaws with bands of slender, pointed, movable, brush-like teeth; nostrils double; preopercle very finely serrated or entire; gill-membranes broadly attached to isthmus, openings restricted to sides; branchiostegals 6 or 7; pyloric cæca few; gillrakers very short; pseudobranchiæ present. Dorsal fins 2, somewhat connected, the first of 8 to 11 spines, which are depressible in a groove; soft dorsal and anal fins anteriorly high, their bases thickened by scales; anal spines 3 or 4, short; caudal fin truncate or doubly concave; pectoral short, rays all branched; ventrals thoracic, normally I, 5; sometimes rudimentary; a large accessory scale as in the *Sparidæ;* air-bladder large, commonly bifurcate in front, and with 2 slender horns behind. Vertebræ 10 + 14 = 24. Post-temporal bifurcate, as usual among fishes, not joined to skull.

As here understood, the *Ephippidæ* comprise about 4 genera and 10 or 12 species, related to the *Chætodontidæ* but showing important differences in the skeleton, which shows resemblances to both scombroid and sparoid forms. Shore fishes, mostly of large size, in warm seas, often valued as food.

The following diagnosis of this family is given by Dr. Gill: "Chætodontoidea with a wide scaly isthmus extending from pectoral region to the chin and separating the branchial apertures; spinous partially differentiated from soft portion of dorsal; upper jaw scarcely protractile; ethmoid cariniform above (not sunk and concave) and vomer declivous (not projecting forward or retuse); parapophyses spiniform and posteriorly inclosing a hæmal canal, and post-temporal bones bifurcated."

Genus 112. CHÆTODIPTERUS Lacépède.

Body much elevated and compressed, its outline nearly orbicular, anterior profile nearly vertical. Scales small, 55 to 70 in course of lateral line. Jaws about equal; no teeth on vomer or palatines; teeth on jaws slender, somewhat movable; preopercle finely serrulate. Branchiostegals 6. Dorsal fins 2, somewhat connected, first usually of 9 spines, the third of which is elongate; anal spines 3, small, second the longest; ventral with large accessory scale. Pyloric cæca 4 to 6.

An American genus distinguished from the Asiatic *Ephippus*, by the very much smaller scales.

204. Chætodipterus faber (Broussonet). "*Paguala*"; *Angel-fish; Spade-fish.*

(PLATE 33.)

Head 3.5; depth 1.1 to 1.75; eye 4.2; snout 2.6; maxillary 3.5; interorbital 2.6; preorbital 4.7; D. VIII-I, 20 to 22; A. III, 18; pectoral 1.8; ventral 1; caudal 0.8; scales about 60. Body nearly orbicular, greatly compressed, caudal peduncle short and slender; head small, not pointed; mouth very small, the equal jaws with broad brush-like bands of slender, very closely set, movable, pointed teeth; maxillary not reaching front of eye; profile of snout nearly vertical; spinous dorsal low, the third spine much enlarged, its membrane black; fourth spine enlarged, but shorter than third, widened and flattened, the other spines short and partially embedded; soft dorsal and anal densely covered throughout with very fine scales; the anterior rays much produced, those of dorsal 1.4 in body, of anal 2.2; bases of these fins with sheaths of scales intermediate in size between those of body and those of rest of fin; pectoral small, with fine scales on outer side; ventral long, falcate, densely scaled, the first ray produced and filamentous; caudal large, scaly at base, its margin slightly concave. The young have the third dorsal spine much more produced than in adult, reaching past middle of produced rays of soft dorsal, the black membrane continued to tip; the anterior soft dorsal rays are much less produced in the young and the body is deeper than in the adult.

Color in spirits: Pearly-gray, with dark vertical bands; one from occiput through eye to lower margin of cheek; a second from front of dorsal to belly behind base of ventrals, extending slightly upon opercle; a third from under spinous dorsal downward, tapering out below middle of side; a fourth from last dorsal spines to front of anal; a fifth from middle of base of dorsal to near end of base of anal; sixth and last at base of caudal, faint; these bands plainest in young, almost or quite disappearing in old individuals; ventrals black. .

The spade-fish ranges from Cape Cod to Rio Janeiro. It is occasionally taken at New York and a few have been caught in traps at Menemsha Bight near Woods Hole in August and September. It is not uncommon about the mouth of the Chesapeake and increases in abundance southward to Key West and Pensacola, at which latter place it is called "spade-fish," while at Key West, along the east coast of Florida, and on the Carolina coast it is known as the "angel-fish," a name which, according to Schœpf, appears to have been current for over a century at Beaufort, N. C., where it is also called "porgee" or "porgy," names which are also in use for this species among the New York fishermen. In the West Indies it is known from Cuba, Santo Domingo, Jamaica, Martinique, and Porto Rico. We obtained specimens from San Juan, Mayaguez, Puerto Real, Arroyo, and Isabel Segunda, and it is doubtless common everywhere about the island in suitable places. It has also been recorded from the coasts of Guatemala and Texas. It has been erroneously reported from the Pacific coast of America, particularly from San Diego, Cal., the Pacific coast species (*Chætodipterus zonatus*) being an entirely different fish.

Mr. Silas Stearns studied the habits of the spade-fish on the coasts of west Florida, Alabama, and Louisiana, where it is common. He says it is found throughout the summer and fall in the bays, about wharves, rock piles, and old wrecks, where crustaceans are abundant. In October and November large schools are seen along the sea-beaches, evidently leaving the coast for warmer water, at which time many are caught in haul seines. In that region they probably spawn in early summer, and the young are seen until October.

The spade-fish reaches a length of 2 or 3 feet and a weight of 20 pounds, although the average size of those caught is much less. Mr. Stearns gives 15 inches as the largest he has seen, and the average at not more than 8 inches. Much larger ones were examined by us at Key West and at Fort Pierce and Eden, on Indian River. The largest seen in Porto Rico was about 14 inches long. Very large examples, which have been described as *Ephippus gigas*, but which are evidently adults of unusual size of this species, have the occipital crest and anterior interhæmals developed into large, thick, bony masses, which are quite remarkable in appearance.

The spade-fish has in the last twenty-five or thirty years come to be one of the most highly prized food-fishes, and is held in very high esteem by connoisseurs in Washington and New York, in the markets of which cities it is most abundant during the summer months.

Chætodon faber Broussonet, Ichth. Decas., 1, V, pl. 4, 1782, Jamaica; Carolina; Society Islands.
Faber marinus fere quadratus (the Pilot-fish) Sloane, Nat. Hist. Jamaica, II, 290, pl. 251, 1793, Jamaica.
Zeus quadratus Gmelin, Syst. Nat., I, 1225, 1788, Jamaica; after Sloane.
Chætodon plumieri Bloch, Ichth.; pl. 211, 1793, Martinique; after Plumier.
Selene quadrangularis Lacépède, Hist. Nat. Poiss., IV, 564, 1803, Jamaica; after Sloane.
Chætodon oviformis Mitchill, Trans. Lit. and Phil. Soc., I, 1815, 247, pl. 5, fig. 4, New York.
Ephippus gigas Cuvier, Règne Animal, ed. 2, II, 191, 1829, America; Stahl, l. c., 163, 1883.
Ephippus faber, Poey, Fauna Puerto-Riqueña, 330, 1881; Stahl, l. c., 77 and 163, 1883.
Chætodipterus faber, Jordan & Evermann, l. c., 1668, 1898.

Family LIV. CHÆTODONTIDÆ. The Butterfly-fishes.

Body strongly compressed, elevated, suborbicular in outline, covered with moderate-sized or small scales, which are finely ciliated or nearly smooth; lateral line present, concurrent with back, not extending on caudal fin; mouth small, protractile, terminal; maxillary very short, irregular in form, divided into two by a longitudinal suture; upper part of skull solid, occipital crest strong; post-temporal firmly joined to skull, its form really trifurcate though appearing simple, interspaces between forks filled in by bone so that only a foramen is left; last bone of suborbital ring firmly joined to preoperculum; teeth brush-like or setiform, often extremely long, in narrow bands in jaws; no teeth on vomer or palatines; no canines, molars, or incisors; eyes lateral, of moderate size; branchiostegals 6 or 7;

pseudobranchiæ very large; air-bladder present. Gill-membranes more or less attached to isthmus; gillrakers very small. Dorsal fin single, continuous, its rays sometimes filamentous, its soft part as well as soft part of anal densely covered with small scales; anal similar to soft dorsal, with 3 or 4 spines; ventrals thoracic, I, 5; caudal usually truncate. Vertebræ 10 + 14 = 24, the anterior abbreviated; insertion of ribs inferior; post-temporal usually reduced and not bifurcate.

Carnivorous fishes of the tropical seas, noted for their singular forms, bright colors, and great activity. The family comprises 8 to 10 genera and about 180 species, most of them belonging to *Chætodon* and *Pomacanthus*. Their excessive quickness of sense and motion enables these fishes to maintain themselves in the struggle for existence in the close competition of the coral reefs, notwithstanding their bright colors. The young are very different from the adult, and pass through a stage termed *Tholichthys*, in which the membranes are greatly developed, forming collars and sheaths about head and neck.

CHÆTODONTINÆ:
  a. Preopercle unarmed; dorsal spines not graduated, some of median spines longer than last spines; scales comparatively large (young with the *Tholichthys* form).
  b. Snout (nasal, palatines, etc.) with premaxillaries, articular, and dentary bones much produced, beak-like; cleft of mouth with maxillaries, short; lateral line ceasing under soft dorsal.
  c. Dorsal spines 12 or 13; soft rays about 20 (19 to 23).
  d. Scales large; beak moderate .... PROGNATHODES
  bb. Snout little if at all produced; dorsal spines usually 12 to 14, not graduated, some of middle ones highest; anal spines 3 .... CHÆTODON, 113
POMACANTHINÆ:
  aa. Preopercle armed at its angle with a very strong spine, which is sometimes grooved.
  e. Interopercle unarmed; vertical limb of preopercle above spine entire or nearly so; dorsal fin with 8 to 11 spines, its soft rays 23 to 32 .... POMACANTHUS, 114
  ee. Interopercle short and broad, armed with 1 to 4 strong spines; preopercle serrate or spinous; dorsal spines about 14, graduated, last one longest; scales rather small; isthmus very narrow.
  f. Vertical limb of preopercle simply serrate, with 10 to 30 small teeth; body oblong, rather robust .. HOLACANTHUS, 115
  ff. Vertical limb of preopercle with 3 to 9 conspicuous spines; body ovate, much compressed ..... ANGELICHTHYS, 116

Genus 113. CHÆTODON (Artedi) Linnæus.

Body short, deep, very strongly compressed, especially above and behind; head small, compressed, almost everywhere scaly; mouth very small, terminal, jaws provided with long, slender, flexible, bristle-like teeth; vomer sometimes with teeth; preoperculum entire or nearly so, without spine. Dorsal fin single, continuous, not notched, spinous part longer than soft part, of about 13 spines, spines not graduated, some of middle ones being longer than the last; last rays of soft dorsal usually rapidly shortened, some of them occasionally filamentous (in East Indian species); caudal peduncle short, caudal fin fan-shaped; anal similar to soft dorsal, preceded by 3 strong spines. Body covered with rather large ctenoid scales, somewhat irregular in their arrangement; lateral line curved, high, parallel with back. Gill-openings rather narrow, membranes narrowly joined to isthmus; branchiostegals 6.

A very large genus of singular and beautiful fishes, abounding in the tropical seas, especially about volcanic rocks and coral reefs; most of them have the body crossed by transverse black bars. They are all very active, feeding on small animals.

  a. Scales on trunk all subequal, their posterior margins regularly rounded. None of the rays of soft dorsal produced.
CHÆTODONTOPS:
  b. Series of scales below axis of body running obliquely upward and backward, lowest becoming more or less horizontal.
  c. Base of soft dorsal with a large black spot, not ocellated .... *ocellatus*
  d. Humeral band absent.
  e. Body with a dark band between dorsal and anal; no caudal ocellus.
  f. Ocular band edged with yellowish or whitish above; soft dorsal and anal with much black .... *sedentarius*
  ff. Ocular band jet-black, not white-edged; soft dorsal and anal without black .... *aya*
  ee. Body without black crossbands, ocular band only present; an ocellus on caudal peduncle .... *atæniatus*
CHÆTODON:
  bb. Series of scales below axis of body extending downward and backward, forming an angle with those above, each series marked by a continuous black streak.
  g. Body without ocelli, crossed by dark bands .... *striatus*, 205
  gg. Body with a large black ocellus below soft dorsal .... *capistratus*, 206
  ggg. Body with 2 ocelli, a large one on caudal peduncle and a smaller one on first 8 or 9 soft rays of dorsal ... *bricei*, 207

205. **Chætodon striatus** Linnæus. "*Mariposa*"; *Butterfly.*

(PLATE 34.)

Head 3; depth 1.6; eye 3.2; snout 2.8; interorbital 3.25; D. XII, 20 or 21; A. III, 16 or 17; pectoral 1.3; ventral 1.25; caudal 1.7; scales 8–38 to 40–16. Body ovate, much compressed, covered with large ctenoid scales, the series of which above axis of body run obliquely upward and backward, those below downward and backward; head small, pointed, with much smaller scales, anterior profile slightly concave; snout somewhat produced; mouth very small, terminal, with brush-like teeth in jaws; dorsal fin continuous, spines graduated, strong and pungent, soft rays densely covered with small scales graduated in size, becoming smaller toward margin of fin; anal similar to dorsal, both angulated behind; caudal convex.

Color in life: Ground-color very light yellow, almost white; narrow longitudinal dark stripes between rows of scales visible through the brown crossbands; a black stripe about half width of eye from occiput through eye to lower side of head, not extending on breast; a second broad band, brown in color, wider above, where it is greater than width of eye, from first dorsal spines downward across side, meeting its fellow on belly in front of vent; another band, similar to last in color and size, from last dorsal spines across body and extending upon anal fin; another on soft dorsal, yellowish-brown, narrowly joined at its top to the preceding, extending downward on soft dorsal, caudal peduncle, and posterior part of base of anal, where it is joined to ventral end of preceding bar; first three of these bars slightly curved, their concavities backward; margins of soft dorsal and anal with a narrow band of black, bordered on its inner edge with brownish-yellow, on its outer edge by a narrow pale stripe, outside of this a yellow one; this same combination of color-bands extending vertically on middle of caudal, which is pale posteriorly; a black blotch on caudal peduncle; a rounded black blotch on anterior portion of soft dorsal, sometimes absent or merging with the surrounding color, very distinct and ocellated in young of about 2 inches; iris yellow, save where crossed by the black band; yellow shades on top of head; breast dusky; membrane of second, third, and fourth dorsal spines black at base, the color extending on base of spines; membrane of longest spines yellow outwardly; pectoral pale; ventral black outwardly, light-greenish near base, a little yellow on membrane of spine.

In spirits, the delicate color shading disappears but the main features of the markings persist.

A beautiful little fish, rarely over 6 or 7 inches in length, rather common from the West Indies to Brazil; recorded by Jordan & Rutter from Jamaica and fairly abundant in Porto Rico. Numerous specimens, 1.75 to 4.5 inches long, were seined at Mayaguez, Puerto Real, Ponce, and Arroyo.

Chætodon striatus Linnæus, Syst. Nat., ed. X, 275, 1758, Indies; Jordan & Evermann, l. c., 1677, 1898.

206. **Chætodon capistratus** Linnæus. "*Mariposa*"; *Parchë; Butterfly.*

(PLATE 35.)

Head 2.9; depth 1.7; eye 2.9; snout 2.9; interorbital 3.5; D. XII or XIII, 19 or 20; A. III, 17; pectoral 1.2; ventral 1.25; caudal 1.4; scales about 40. General form of *Chætodon striatus*, series of scales both above and below more oblique; those above upward and backward, those below downward and backward; very distinct blue stripes between rows of scales, sometimes zigzag or undulate, sharply marking their difference in direction; a black band, edged with white, from occiput across head through eye, as in *C. striatus;* a diffuse brownish vertical bar across body from first dorsal spines to below pectoral; a round jet-black ocellated spot, larger than the eye, on body under soft dorsal, the lateral line extending upon it, surrounded by an obscure brownish shade; soft dorsal and anal and basal portion of caudal with a narrow black stripe edged inwardly with brown and outwardly with yellow; basal portion of the anal yellowish, tip of fin bright yellow; spinous dorsal pale-blue, yellow-edged; outer portion of caudal pale blue; ventrals yellow; iris, snout, breast, and belly yellow. In spirits, the blue lines become brown, and the yellow shades pale.

One of the smallest and handsomest of the chætodonts, probably never exceeding 4 or 5 inches in length. It is found from southern Florida southward through the West Indies, and is generally common. It is recorded from Key West, Havana, Jamaica, and Porto Rico. Numerous examples, each about 2 inches long, obtained by us at San Antonio Bridge, Mayaguez, Porto Real, Boqueron, Hucares, and Fajardo; the most abundant chætodont in Porto Rico.

Chætodon capistratus Linnæus, Syst. Nat., ed. X, 275, 1758, Indies; Jordan & Evermann, l. c., 1677, 1898.

207. Chætodon bricei H. M. Smith. "*Mariposa*"; *Butterfly.*

Head 2.5; depth 1.7; eye 2.8; snout 3.2; interobital 3; D. xiii, 20; A. iii, 17; pectoral 1.4; ventral 1.2; caudal 1.4; scales 6–40–17. Close to *C. capistratus*, but with 2 ocelli, the larger one, on body under soft dorsal, rather elliptical in shape, the smaller one, size of eye, directly above the larger, on anterior rays of soft dorsal; the brown band from spinous dorsal across body is deeper in color and its edges are more sharply defined than in *C. capistratus*, and the broad posterior brown band of body is relatively larger and more distinct, extending from soft dorsal to anal and involving both ocelli.

One example only in the collection, 1.25 inches in length, collected at Fajardo. Hitherto known only from Woods Hole, Mass., where 6 specimens were taken in 1897 and 42 in September, 1899, by the author of the species.

Chætodon bricei H. M. Smith, Bull. U. S. F. C. 1897, 102, Woods Hole, Mass.; Jordan & Evermann, l. c., 1678, 1898.

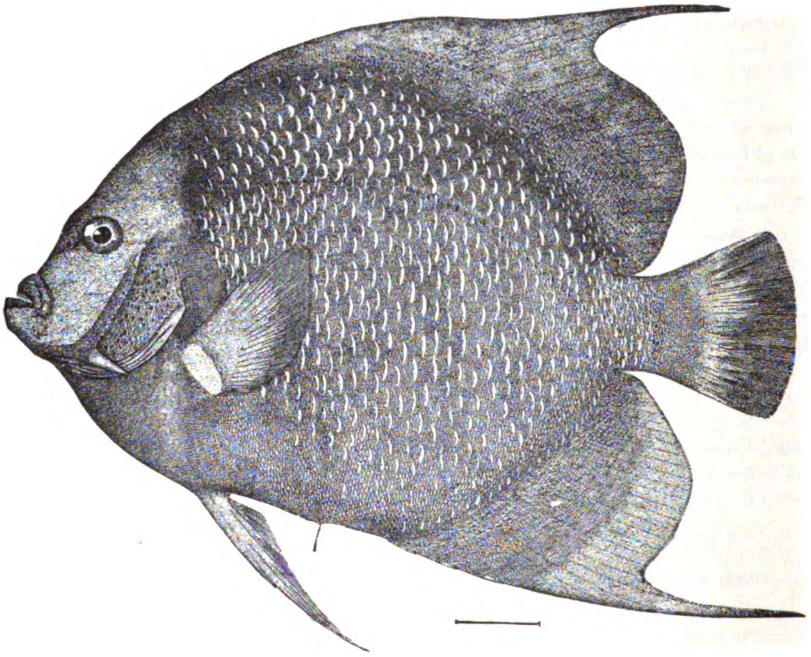

FIG. 69.—*Pomacanthus arcuatus.*

Genus 114. POMACANTHUS Lacépède. Chirivitas.

Body much compressed and elevated, covered with small scales, among which smaller ones are distributed so that the series are not distinct; preopercle with a very strong spine at its angle, vertical limb entire in adult, usually serrulate in young; interopercle entire or nearly so; dorsal fin entirely scaly, with 8 to 11 graduated spines; soft dorsal usually much elevated in front; anal with 3 graduated spines; branchiostegals 6; air-bladder with 2 posterior horns; pyloric cæca numerous.

Found in the tropical seas; few species, chiefly American; the young brilliantly colored, the adult usually dull-colored. The species vary greatly with age and have been almost inextricably confused, as the age variations are much more striking than the specific distinctions. The number of dorsal spines is usually diagnostic.

a. Dorsal spines viii to x, 29 to 32.

b. Scales in lateral line about 50 to 55; dorsal viii or ix, 30 to 32; A. iii, 24. Color of adult steel-gray or scarcely yellowish; young with 4 whitish crossbands .... *arcuatus*, 208

bb. Scales in lateral line 70 to 90; dorsal usually x, 29 or 30; anal iii, 23 or 24. Color black in adult, with yellow mottlings; base of pectoral yellow; young with several yellowish crossbands .... *paru*

208. Pomacanthus arcuatus (Linnæus). "*Mariposa*"; *Black Angel; Chirivita; Portugais.*

Head 4; depth 1.4; eye 4; snout 2.1; interorbital 3.1; preorbital 2.75; D. ix, 30 to 32; A. iii, 24; pectoral 1.1; ventral 0.75; caudal 0.9; scales 8–53–27. Body nearly orbicular, greatly compressed and elevated, covered with large scales interspersed with smaller ones, not in regular series; nape, head, and breast with fine scales; dorsal and anal densely scaled to margins and tips of produced rays; a strong flat spine at angle of preopercle, head otherwise unarmed, save for a few serrulations on upper limb of preopercle; dorsal and anal with a few of their anterior rays produced, reaching beyond truncate caudal.

Color in spirits: Grayish-olive, most of scales of body very dark brown with a pale edge, the color not on scales, but on membranous expansions of the integument lining the scales; caudal with a broad, pale edge; young much darker, sometimes nearly black, with white, arcuate, vertical bars, one from nape across head behind eye to breast, another from spinous dorsal across body behind pectoral to vent, a third from soft dorsal to anal, the ends extending on fins, one or more of these bars often absent; a median white line on top of head; a pale bar from angle of mouth downward; chin dusky, with a white spot at symphysis, sometimes chin and lower jaw pale; caudal with a pale bar at base, sometimes narrowly connected along outer rays with the pale marginal bar, thus surrounding a dark area in middle of fin; posterior margin of dorsal and anal very narrowly pale-edged.

The black angel is generally common in the West Indies and is occasionally taken as far north as New Jersey and as far south as Bahia. It is known from Key West, the Tortugas, Cuba, Jamaica, Porto Rico, and Martinique. Our specimens from Porto Rico are 5 to 12 inches long and were obtained at Puerto Real, Isabel Segunda, and Culebra. It is probably not uncommon in suitable places about the island. It reaches a length of 1 to 2 feet, and is of some value as food. At Key West it is found throughout the year, and is caught chiefly in traps, though it is frequently taken with spear or hook. The average weight of those taken at Key West does not exceed 2 or 3 pounds, and the largest rarely weigh more than 6 pounds.

Chætodon arcuatus Linnæus, Syst. Nat., ed. X, India; from spec. Mus. Ad. Fr.; D. viii, 30; dusky with 5 dark bands.

Chætodon aureus Bloch, Ichthyol., pl. 193, fig. 273, 1758, Martinique; on a drawing by Plumier, the spines 9 in the original drawing; Poey, Fauna Puerto-Riqueña, 329, 1881.

Chætodon lutescens Bonnaterre, Encycl. Méth., 182, 1788, Jamaica; after Browne.

Chætodon littoricola Poey, Synopsis, 351, 1868, Cuba; black fins bordered with yellowish; fin rays not counted; Poey, Fauna Puerto-Riqueña, 329, 1881; Stahl, l. c., 77 and 164, 1883.

Pomacanthus balteatus Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 208, 1831, Porto Rico (Coll. Plée).

Pomacanthus cingulatus Cuv. & Val., Hist. Nat. Poiss., VII, 209, 1831, West Indies; probably sent by Plée from Porto Rico.

Pomacanthus quinquecinctus Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 210, 1831, West Indies; probably from Porto Rico.

Pomacanthus arcuatus, Jordan & Evermann, l. c., 1679, 1898.

Genus 115. HOLACANTHUS Lacépède. Catalinetas.

Body oblong, rather robust, back not greatly elevated nor compressed; scales rather small, roughish, often mixed with smaller ones. Vertical limb of preopercle with small equal serræ; a strong spine at angle of preopercle, this usually grooved; interopercle short, armed with 1 to 4 strong spines. Dorsal fin with 12 to 15 strong spines, which are usually graduated, increasing in height to the last; soft dorsal moderate, with 17 to 20 rays, usually not ending in streamers. Coloration usually brilliant and well defined, changes due to age less than in *Pomacanthus*.

Species numerous in all tropical seas, abounding about coral reefs.

209. Holacanthus tricolor (Bloch). "*Palmoneta*"; *Rock Beauty; Catalineta; Vaqueta de dos Colores.*

(Plate 36.)

Head 3.4; depth 2.1; eye 4.4; snout 2.2; interorbital 3; preorbital 4.7; D. xiv, 18; A. iii, 18; pectoral 1.4; ventral 1.1; caudal 1.3; scales 8–48–24. Body oblong, little elevated and not greatly compressed; scales for the most part regularly imbricated, exposed portion with many fine parallel ridges ending as very fine sharp points, making the scales extremely ctenoid; mouth small, prominent; preorbital with an antrorse and a retrorse spine varying greatly with age; a long and strong spine at angle of preopercle, the upper limb with a row of short spines; 2 spines on lower limb, and about 4 on interopercle; soft dorsal and anal with one or more rays, the seventh or eighth, or adjoining ones, produced in fine filaments, the dorsal slightly the longer, reaching end of caudal; caudal convex, its upper and lower rays produced in slender filaments, the upper the longer.

Color in life: Caudal, pectoral, and ventral fins, and the forward parts in front of a line from fourth dorsal spine to near base of pectoral, thence to third anal spine, bright golden-yellow; rest of trunk and most of dorsal and anal deep black; reddish-orange on preopercular spine, edge of opercle, and horizontal margins of dorsal and anal, the vertical margins and produced rays of which are yellow; orange punctulations on caudal; lips pale-blue, becoming black in spirits; breast dusky; iris yellow, blue above and below.

The rock beauty is one of the most gorgeously colored of tropical fishes, the rich orange of the head, tail, and anterior third of trunk, and the soft, satiny-black of the rest of the body, together with the narrow red and orange borders of dorsal and anal fins, give the fish a most striking appearance. The line of demarcation between the colors is everywhere abrupt and clean cut, and the contrast is as great as it could well be.

This interesting fish is not uncommon in the West Indies, ranging south to Bahia and north to the Bermudas. It is known from Cuba, Bermuda, Jamaica, Porto Rico, St. Thomas, Guadaloupe, Trinidad, and Bahia, but has not been recorded from southern Florida or the Bahamas. Specimens were obtained by us at Arroyo and Isabel Segunda, but it was not seen elsewhere. This species reaches a length of a foot or more, and is regarded as a good food-fish. It frequents water of moderate depths about the coral reefs and is usually taken in the fish traps or baskets.

Catalineta, Parra, Descr. Dif. Piez., Hist. Nat. Cuba, 12 pl., VII, fig. 2, 1787, Cuba.
Chætodon tricolor Bloch, Ichth., pl. 426, 1795, Cuba.
Holacanthus tricolor, Jordan & Evermann, l. c., 1684, 1898.

Genus 116. ANGELICHTHYS Jordan & Evermann. Isabelitas.

This genus is separated from *Holacanthus* by the presence on the ascending limb of the preopercle of several stout graduated spines in addition to the large grooved spine at the angle. The soft dorsal and anal are much falcate and the preorbital is without spine; interopercle armed with 1 to 4 spines; scales rather large; body ovate, rather deep, and compressed. The known species are among the largest of the chætodonts and perhaps the most gaily colored of all. Species all American.

a. Spines on ascending limb of preopercle moderate, longest less than one-fourth length of large spine at angle.
b. Nape with a blue ocellus; soft dorsal and anal edged with dark-blue; depth 1.87 in length in adult..... *ciliaris*, 210
bb. Nape without distinct ocellus; no dark-blue edgings to soft dorsal and anal; body deep, the depth 1.6 in length in adult.. *isabelita*

210. Angelichthys ciliaris (Linnæus). "*Mariposa*"; *Blue Angel-fish; Isabelita.*

(PLATE 37.)

Head 3.8; depth 1.8; eye 4.7; snout 2.6; interorbital 3; preorbital 3.8; D. XIV, 21; A. III, 21; pectoral 1.2; ventral 1; caudal 1.1; scales 47. Body oblong and compressed; head small, obtusely pointed; scales on body of various sizes, a large series of regularly imbricated ones, with many much smaller ones between, all strongly ctenoid, those of head much smaller than the large scales of body; preopercle with a very strong grooved spine at angle, upper limb with shorter strong spines, irregular in length; 2 spines on lower limb, about 3 on interopercle and 3 on lower margin of opercle, these sometimes reduced in number or entirely absent; preorbital ending in 3 diverging spines; spines of head subject to variation in number and size with age of specimen; middle rays of soft dorsal and anal much produced, reaching beyond caudal, the fins densely scaled.

Color in life: Ground-color blue, margins of scales yellowish; sides of head pale-yellow; branchiostegal membranes, pectoral, ventral, and caudal fins lemon-yellow; dorsal and anal reddish-orange, with bright-blue border, bases of soft portions shaded with blue of body, their last rays with a dark blotch, their produced tips yellow; pectoral with an olive base bordered anteriorly by a pale-blue stripe, posteriorly by a semicircular black line; nape with a large round deep-blue spot ocellated with pale-blue and containing pale-blue specks; iris yellow, with a blue upper and lower edge; preorbital spines pale-yellow, other spines of head blue. All the bright colors fade in spirits, leaving a ground-color of olive, the lighter edges of scales standing out prominently; ocellus persistent.

The variation in the color of this species is considerable. While the blue ground-color is usually sufficiently strong to justify the name "blue angel-fish," the yellow margins of the scales are sometimes so broad as to give the fish a decidedly yellow appearance, which accounts for the name "yellow angel-fish," by which the species is known at Key West.

This is a very handsome fish and, like the rock beauty, appears very striking when seen swimming leisurely in the clear water about the coral reefs. It is known from southern Florida through the West Indies to Brazil; it has been recorded from the Tortugas, Key West, the Bahamas, Cuba, Jamaica, the Bermudas, the Lesser Antilles, and Bahia. Specimens 9 to 13 inches long were obtained by us at Ponce and Culebra, and it is doubtless a common species about Porto Rico. At Key West it is probably the most common of the 4 angel-fishes occurring there. It attains a good size (1 to 2 feet in length) and is a fair food-fish. Like all similar fishes, it is usually caught by traps, though it sometimes takes a baited hook.

Angel-fish, Catesby, Nat. Hist. Carolina, etc., 1737.
Isabelita, Parra, Dif. Piezas, etc., 1787, Cuba.
Chætodon ciliaris Linnæus, Syst. Nat., ed. X, 276, 1758, Indies; in part.
Chætodon squamulosus Shaw, Naturalists' Miscellany, 275, 1789–1813; after Angel-fish of Catesby.
Chætodon parræ Bloch & Schneider, Syst. Ichth., 235, 1801, Cuba; after Isabelita of Parra.
Holacanthus cornutus Desmarest, Décade Ichthyologique, 44, pl. 3, fig. 3, 1823, Cuba.
Holacanthus formosus Castelnau, Anim. Nouv. ou Rares de l'Amér. du Sud, Poissons, 19, pl. 2, fig. 2, 1855, Bahia.
Angelichthys ciliaris, Jordan & Evermann, l. c., 1684, 1898.

Family LV. TEUTHIDIDÆ. The Surgeon-fishes.

Body oblong, compressed, and usually elevated, covered with very small scales; lateral line continuous. Tail armed with one or more spines or bony plates. Eye lateral, high up; preorbital very narrow and deep. Nostrils double. Mouth small, low; each jaw with a single series of narrow incisor-like teeth; vomer and palatines toothless; premaxillaries somewhat movable, but not protractile; maxillary short, closely united with premaxillary; gillrakers obsolete; pseudobranchiæ large; gills 4, a slit behind fourth; gill-membranes attached to isthmus, openings thus restricted to sides. A single dorsal fin, with strong spines, spinous part of fin shorter than soft part; anal fin similar to soft dorsal; pectoral moderate; ventral fins present, thoracic, mostly I, 5, never I, 4, I. Pelvic bones long, narrow, curved, closely connected, evident through skin, as in *Balistidæ*, with which group the *Teuthididæ* have the closest affinities. Pyloric cæca rather few; air-bladder large; intestinal canal long. Vertebræ 9 + 13 = 22. Posterior suborbital bones in close contact with preopercle; post-temporal immovably united with skull, apparently simple, but really trifurcate, with interspaces filled in with bone, the foramen not passing through it; interneural bones with transversely expanded buckler-like subcutaneous plates, which intervene between spines and limit their motion forward; epipleurals developed from ribs.

Herbivorous fishes of the tropical seas.

Genus 117. TEUTHIS Linnæus. The Tangs.

This genus includes those *Teuthididæ* which have the tail armed with a sharp, antrorse, lancet-like, movable spine; strong, fixed, incisor teeth; ventral rays I, 5, and usually 9 spines in dorsal fin. The numerous species are found in all tropical seas. Herbivorous fishes, living about coral reefs; adult protected by the murderous caudal spine, which grows larger with age. Of the six species of this genus known to occur in America north of the Equator, three are known from Porto Rico.

a. Outline rhomboid, depth 1.5 in length; color brown, washed with deep blue .... *cæruleus*, 211
aa. Outline ovate, depth about 2 in length; color brown, never blue.
b. Caudal simply lunate .... *hepatus*, 212
bb. Caudal deeply emarginate. Upper lobe of caudal produced in a filament .... *bahianus*, 213

211. Teuthis cœruleus (Bloch & Schneider). "*Médico*"; *Barbero; Blue Tang.*

(PLATE 38.)

Head 3.4; depth 1.75; eye 4.5; snout 1.3; interorbital width 3; preorbital 1.67; D. IX, 26; A. III, 25. Body rhomboid, anterior profile subvertical, nearly straight, making an angle of about 60° with axis of body; dorsal outline from origin of dorsal fin to caudal peduncle a gentle convex curve; ventral outline a regular curve from snout to caudal peduncle; mouth slightly below axis of body; least depth of caudal peduncle 2 in snout. Dorsal fin moderate, longest spines about 2.4 in head, a little shorter than longest rays; longest anal rays about 2.75 in head, longest anal spine 2; pectoral long, slightly falcate, as long as head; ventrals 1.5 in head; caudal deeply lunate, its lobes subequal, middle rays about half length of outer, which are about a sixth longer than head.

Color, rich blue throughout, body with about 45 or 50 narrow longitudinal lines of lighter blue or purplish; no blue lines on breast or head; no crossbars; dorsal crossed by alternating lines of rich blue and light brown, the edge broadly light blue; caudal blue, a subterminal brown border, then a border of rich blue; anal like dorsal; ventral rich blue; pectoral lighter blue; young with blue shades less evident. A specimen, 3.25 inches long, had sides olivaceous-blue, rich blue on belly; side with many narrow pale-blue, almost white, cross-lines; dorsal, ventral, anal, breast, and chin rich sky-blue; lips whitish; caudal olivaceous, bordered all round by blue; spine pale-yellowish.

The blue tang is generally common from the Bermudas and southern Florida to Brazil. It has been recorded from the Tortugas, Key West, Cuba, and Jamaica. It is common about Porto Rico, numerous specimens having been obtained at Aguadilla, Arroyo, and Culebra, but it is apparently less abundant than either *T. hepatus* or *T. bahianus*. It ordinarily does not reach a greater length than 8 or 10 inches, and is usually found in the algæ in water of but a few feet in depth. The larger individuals are found in deeper water about or near the coral reefs.

Turdus rhomboidalis, Catesby, Nat. Hist. Carolina, etc., 1742.
Acanthurus cœruleus Bloch & Schneider, Syst. Ichth., 214, 1801, Carolina, Havana, and Jamaica; based on Catesby Parra, and Browne.
Acanthurus broussonetii Desmarest, Prem. Déc. Ichth., 26, 1823, Cuba.
Acanthurus brevis Poey, Memorias, II, 207, 1860, Havana.
Acronurus cæruleatus Poey, Enumeratio, 69, 1875, Cuba; young.
Teuthis cæruleus, Jordan & Evermann, l. c., 1691, 1898.

212. **Teuthis hepatus** Linnæus. *"Médico"; "Barbero"; Tang; Doctor-fish; Lancet-fish.*

Head 3.5; depth 2; eye 3.5; snout 1.6; interorbital 3.3; preorbital 1.8; D. IX, 24 to 26; A. III, 22 to 24; pectoral 1.2; ventral 1.4; caudal 1.1; scales numerous. Body ovate, back greatly elevated, anterior profile very steep and moderately convex; caudal lunate, lobes about equal.

Color in life: Dark olive-brown, sides with about 12 black vertical bars narrower than interspaces, plainer in young; a brownish stripe along base of dorsal; spinous dorsal with alternate stripes running upward and backward, of dark-blue and bronze-olive, the two colors of about equal width; soft dorsal with a bluish streak on anterior side of each ray, and a bronze stripe behind it; fins dark, often almost black. A young example, taken at San Juan, was olivaceous, with narrow vertical blue bars; spine pale, surrounded by rich blue; branchiostegals, breast, and belly pale-blue; anal bluish, especially anteriorly, its border deep blue; ventrals blue; caudal brownish, peduncle yellowish; eye blue and yellow; two or three small postocular orange spots. The vertical bars usually persist in spirits, but other markings fade. In the young the caudal is nearly truncate and without the pale edge of the ocean tang.

This species is the most abundant of the tangs, and is found from the Carolinas and southern Florida south to Brazil. It has been recorded from the Tortugas, Key West, Charleston, Havana, Jamaica, Martinique, and Bahia. About Porto Rico it is the most common of the tangs and was seen by us at nearly every place where collecting was done, particularly at San Juan, Mayaguez, Puerto Real, Ensenada del Boqueron, Guanica, Hucares, and Culebra. It reaches a foot in length, though the specimens obtained do not exceed 6 or 7 inches. It is of considerable importance as a food-fish.

Teuthis hepatus Linnæus, Syst. Nat., ed. XII, 507, 1766, Carolina; after *Hepatus mucrone reflexo*, Gronow; Jordan & Evermann, l.c., 1691, 1898.
Chætodon chirurgus Bloch, Ausl. Fisch., 99, pl. 208, No. 24, 1784, Martinique; on a drawing by Plumier.
Acanthurus phlebotomus Cuvier & Valenciennes, Hist. Nat. Poiss., X, 176, 1835, Martinique, Brazil, Havana, and New York; Poey, Repertorio, I, 256, 1867, and Poey, Synopsis, 245, fig. 7, 1868.
Acronurus fuscus Gronow, Cat. Fishes, ed. Gray, 119, 1854, Carolina; same type as *T. hepatus* Linnæus.
Acronurus carneus Poey, Memorias, II, 207, 1860, Cuba; young.

213. **Teuthis bahianus** (Castelnau). *"Médico"; Barbero; Ocean Tang.*

Head 3.5; depth 2 to 2.4; eye 3 to 4.3; snout 1.75; interorbital 3.4; preorbital 1.67; D. IX, 25; A. III, 23. Body ovate, anterior profile moderately convex, making an angle of about 45° with axis of body; ventral outline less arched; caudal fin deeply lunate, upper lobe much the longer, slender and often produced into a filament in adult, inner rays about half length of outer ones, which are longer than head.

Color in life: Dark bluish-brown, blotched with paler below; no transverse bars; brown, wavy, longitudinal brassy streaks on body; 8 dark lines on dorsal fin running parallel with its edge for its whole length, separated by interspaces of similar width; margin of caudal fin bluish, with a violet base; no distinct dark crossbar at base of caudal. A young individual, less than 3 inches long, had sides bluish-brown, with numerous fine, wavy, darker brown longitudinal lines; dorsal, caudal, and anal fins bluish, with darker blue border, caudal palest; pectoral pale; ventrals darker blue; caudal spine bluish.

Though not the most abundant species of the genus, the ocean tang is the most valuable of those found in our waters. It occurs throughout the West Indies and on neighboring coasts of tropical America from southern Florida to Brazil. It has been recorded from Key West, Havana, and Bahia. It is the least common of the three species found at Key West, but about Porto Rico it is the second in abundance. Specimens are in the collections from San Juan, Aguadilla, Mayaguez, Ponce, Arroyo, Hucares, Fajardo, Isabel Segunda, Culebra, and San Geronimo. Large examples were observed in greatest numbers at Culebra, where this was one of the most common fishes seen in the fishermen's boats. A pot or trap basket lifted in our presence by a Tortola fisherman contained 30 good-sized examples of this species, and many others had been taken from the other pots.

The ocean tang apparently reaches the largest size of any of the three species (a foot or more), and is by far the most important as a food-fish. It is held in high esteem by the fishermen from Tortola, St. Croix, and St. Thomas who come to the Porto Rican waters. It is usually caught in the common native trap basket or pot, which is baited with large chunks of the white pulp of the cactus and set in 4 to 10 fathoms of water. Sometimes the fish are "grained," or speared, and occasionally they are taken with hook and line. This is one of the principal fishes that are corned (so that they will keep well for about two weeks), and taken chiefly to Santa Cruz, where they bring about $5 a barrel.

Acanthurus bahianus Castelnau, Anim. Nouv. ou Rares de l'Amér. Sud, 24, pl. 11, fig. 1, 1855, Bahia.
Acanthurus tractus Poey, Mem., II, 208, 1860, Cuba; Poey, Fauna Puerto-Riqueña, 330, 1881; Stahl, l. c., 77 and 164, 1883.
Acronurus nigriculus Poey, Enumeratio, 69, 1875, Cuba; larval form.
Teuthis bahianus, Jordan & Evermann, l. c., 1693, 1898.

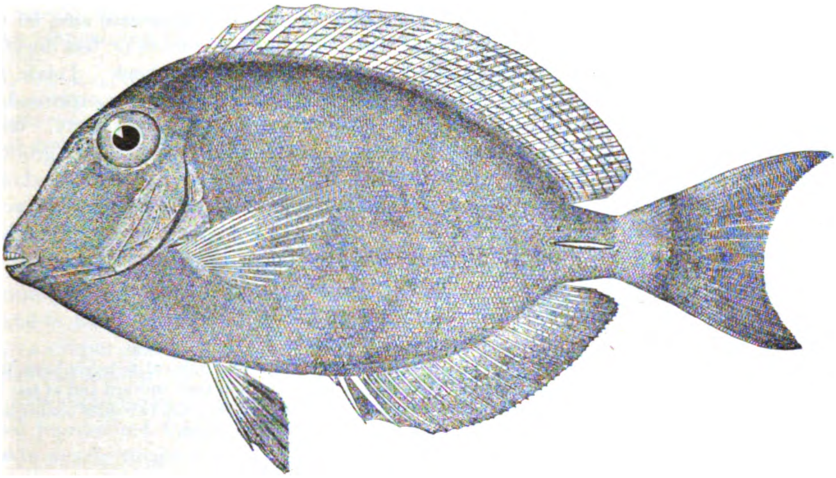

FIG. 70.—*Teuthis bahianus*.

Family LVI. BALISTIDÆ. The Trigger-fishes.

Body oblong, or ovate, moderately compressed, covered with rather large rough scales or scutes of varying form, scutes not forming an immovable carapace. Lateral line obscure or wanting. Mouth small, terminal, low; jaws short, each with about one series of separate incisor-like teeth; eye near occiput; preorbital very deep. Chin without barbel. Gill-openings small, slit-like, above or in front of pectoral fins, and not before eyes. Dorsal fins 2, anterior of 2 or 3 spines, first spine highest, very strong, second locking it in erection; second dorsal remote from first, of many soft rays; caudal fin rounded or forked; ventral fins wanting, their place occupied by a single stout thick spine at end of the very long, usually movable, pubic bone. Post-temporal short, simple, forks obliterated, bone grown solidly to skull, and without foramen. Vertebræ in reduced number (17).

Shore-fishes of the tropical seas, of rather large size, carnivorous or partly herbivorous. The family contains about 9 genera and 50 species. They are very rarely used as food, many of them being reputed as poisonous. According to Dr. Day:

"Eating the flesh of these fishes occasions in places symptoms of most virulent poisoning. Dr. Mennier, at the Mauritius, considers that the poisonous flesh acts primarily on the nervous tissue of the stomach, occasioning violent spasms of that organ and shortly afterwards of all the muscles of the body. The frame becomes racked with spasms, the tongue thickened, the eye fixed, the breathing laborious, and the patient expires in a paroxysm of extreme suffering."

a. Teeth unequal, oblique, each one deeply notched.
  b. Gill-opening with a number of enlarged bony plates or scutes behind it; ventral flap movable, supported by a series of spines, more or less free at tip, and resembling fin rays; cheek entirely scaled, without naked grooves or patches; eye with a groove before it; scales rather small, 50 to 75.
    c. Dorsal and anal fins falcate in adult; caudal lobes acuminate in adult; lateral line slender, undulate, more or less developed; scales of tail and posterior parts unarmed, similar to those on rest of body; ventral flap with slender, sharp spines; third dorsal spine little smaller than second and remote from it .... BALISTES, 118
  bb. Gill-opening with only ordinary scales behind it; no enlarged plates or scutes; ventral flap scarcely movable, its surface scaled; lateral line obsolete; third dorsal spine small or wanting; vertical fins in adult more or less angulate or falcate.
    d. Chin not projecting; cheek closely scaled; dorsal spines 3; scales of posterior parts unarmed or keeled. CANTHIDERMIS
    dd. Chin much projecting; cheek with 3 to 5 narrow parallel grooves; dorsal spines 2; scales of posterior parts more or less keeled .... XANTHICHTHYS
aa. Teeth even, incisor-like; scales of posterior parts more or less keeled; a groove before eye, enlarged scutes behind it; lateral line obsolete; third dorsal spine small or wanting; cheek entirely scaled, but marked by narrow grooves; enlarged scales present behind gill-opening; ventral flap scarcely movable, its surface scaled; vertical fins more or less angulated .... MELICHTHYS

Genus 118. BALISTES (Artedi) Linnæus. Trigger-fishes.

Body compressed, covered with thick, rough scales or plates of moderate size, 50 to 75 in a lengthwise series; a naked groove before eye below nostrils; lateral line more or less developed, very slender, undulate, conspicuous only when scales are dry, extending on cheek. Pelvic flap large, movable, supported by a series of slender, pungent spines. Caudal peduncle compressed, its scales unarmed, without spines or differentiated tubercles similar to those on rest of body. Gill-opening with enlarged bony scutes behind it; cheek entirely scaly, without naked patches or grooves. Both jaws with irregular, incisor-like teeth, usually 4 on each side in each jaw. First dorsal of 3 spines, anterior of which is much the largest, second acting as a trigger, locking first when erected; third nearly as large as second and remote from it; second dorsal and anal long, similar to each other, in adult always falcate or filamentous in front; caudal fin rounded, with outer rays much produced in adult; branchiostegals 6; vertebræ 7 + 10.

Species rather few, chiefly American; some of them straying to the Old World.

CAPRISCUS:
a. Lateral line complete, beginning on lower part of cheek, thence extending upward to behind eye, thence backward to beyond first dorsal, thence abruptly downward to above anal, then upward and at last horizontally backward on caudal peduncle, line everywhere much undulated; lines of the two sides connected by a cross line at nape; dorsal fin falcate or filamentous; dorsal rays about III, 27; A. 25.
  b. Scales moderate, about 60 (50 to 65) in a lengthwise series.
    c. Body with few blue spots or none.
      d. Dorsal and anal with oblique dark bands of bluish spots; young clouded, and with vague, dusky blotches at base of dorsal; scales about 60 .... *carolinensis*
    cc. Body covered with roundish blue-black spots; dorsal and anal similarly spotted .... *forcipatus*
BALISTES:
aa. Lateral line incomplete, usually developed only on head, nape, and caudal peduncle; 37 scales between origin of dorsal and vent .... *vetula*, 214

214. Balistes vetula Linnæus. *Old Wife; Old Wench; Cochino; "Peje Puerco."*

(PLATE 39.)

Head 3; depth 1.8; D. III, 29; A. 27; scales 63. Median part of lateral line, from base of first dorsal to front of caudal peduncle wanting in adult, branch on cheek ceasing opposite gill-opening; cross-branch present; ventral flap well developed, with slender, sharp spines. Scales on head much smaller and more crowded than those on body; third dorsal spine rather shorter and weaker than second, remote from it; caudal fin widely forked, lobes filamentous and about equal; dorsal in adult filamentous at tip; anal little elevated anteriorly.

Color in life: Olivaceous, yellowish below, especially on breast; lips green, bordered behind by a narrow blue line; a narrow blue line narrowly bordered by yellow, from blue line surrounding mouth backward and curving downward across lower side of cheek toward throat; a similar but broader band from above snout across cheek and parallel with first to below base of pectoral; a narrow blue line at base of pectoral; about 8 or 10 narrow, black, wavy lines very narrowly bordered with yellowish-green, radiating from eye; below eye a similar black line extending in an upward curve from above snout to base of pectoral; soft dorsal greenish at base, somewhat purplish above, with 2 or 3 irregular, broken, narrow blue lines near border, these sometimes being more numerous; anterior part of soft dorsal with a narrow blue line extending from base of first ray upward to height of about tenth ray; anal olivaceous with a broad subterminal blue band anteriorly convex and bordered by yellowish; tip of fin and prolonged external rays faint-purplish; caudal peduncle with a broad blue ring anteriorly followed by two narrow pale-blue lines, last at base of caudal fin; caudal greenish-olive, a narrow blue line following direction of first ray for nearly its entire length, and a broader blue subterminal band extending across fin from first to last ray; spinous dorsal purplish and greenish, anterior side of first spine blue, second and third spines pale; iris with an orange ring and radiating lines of white and blue. In alcohol most of these colors disappear, the broad blue lines on side of head changing to blackish.

This interesting fish is found throughout the West Indies and occasionally northward in the Gulf Stream to Woods Hole, Mass.; not uncommon at Key West; recorded by Jordan & Rutter from Jamaica, where it is called "Bessy Cerka"; recorded also from the Bahamas and Ascension Island; probably not uncommon about Porto Rico; the collection contains four excellent specimens from Arroyo, where other individuals were seen in the possession of local fishermen.

Guaperva Marcgrave, Hist. Bras., 163, 1648, Brazil.
Turdus oculo radiato (the Old Wife), Catesby, Hist. Carol., pl. 22, 1725, Bahamas.
Balistes vetula Linnæus, Syst. Nat., ed. X, 329, 1758, Ascension Island: after *Balistes vetula* of Osbeck, Iter Chinensis 294, 1757.
Balistes bellus Walbaum, Artedi Piscium, III, 467, 1792, West Indies; after Froyer.
Chaliosma velata Swainson, Class. Fishes, II, 325, 1839; probably a misprint for *vetula*.
Balistes equestris Gronow, Cat. Fishes, ed. Gray, 31, 1854, American seas.
Balistes vetula, Jordan & Evermann, l. c., 1703, 1898.

Family LVII. MONACANTHIDÆ. The File-fishes.

Body much compressed, covered with very small rough scales, forming a velvety covering; males sometimes with spines on caudal peduncle. Upper jaw with a double series of incisor-like teeth, 6 in outer and 4 in inner series; lower jaw with 6 similar teeth in a single series; first dorsal with a single strong spine and generally a rudimentary one behind it; second dorsal long, similar to anal; ventral fins reduced to a simple osseous, fixed or movable, small appendage at end of long pelvic bone; this appendage often rudimentary or entirely absent; no barbel; vertebræ 7+11 to 14=18 to 21.

Herbivorous shore-fishes of warm seas, closely allied to the *Balistidæ*, differing chiefly in having the first dorsal represented by a single spine, behind which is sometimes a rudiment; scales small, spinigerous, skin mostly rough-velvety. The family contains 6 or more genera and about 50 species, mostly small in size and not used as food, having little flesh and that of a bitterish taste.

a. Pubic bone with a small spine at its end; gill-opening short, nearly vertical; dorsal and anal moderate, each of fewer than 40 rays.
  b. Pelvic spine fixed.
  bb. Pelvic spine movable.
    c. Dorsal spine armed with strong retrorse barbs, usually in two series.......... MONACANTHUS, 120
    d. Dorsal spine with about 4 series of small barbs.......... PSEUDOMONACANTHUS
    dd. Dorsal spine without barbs.......... CANTHERINES, 119
aa. Pubic bone without spine at its end; gill-opening long, oblique; dorsal and anal long, each of 40 or more rays; dorsal spine without barbs, inserted above orbit.......... ALUTERA, 121

Genus 119. CANTHERINES Swainson.

This genus differs from *Monacanthus* chiefly in the absence of barbs on the dorsal spine, which is long, strong, and placed over the front of the eye. Scales minute. Species few.

215. Cantherines pullus (Ranzani). *Lija Colorada; "Peje Puerco."*

Head 3.3; depth about 2; D. II, 35; A. 31. Body moderately elevated; snout moderately produced, upper profile slightly concave; posterior margin of eye directly above axil. Adults (12 inches long) with 2 to 6 pairs of strong recurved spines on each side of tail; caudal short; dorsal spine nearly straight, rather shorter than head, without barbs, serrulate in front, situated above front of eye; skin with a velvety appearance; scales minute.

Coloration variable, generally with a whitish spot behind the last dorsal ray, and several more or less distinct pale longitudinal bands along tail; head with undulated bluish streaks; body sometimes with scattered round light spots, each with a dark speck in center; young sometimes uniform silvery; color probably varying with surroundings. Specimens 7 inches long were, in life, dirty-brown, body sparsely covered with small reddish-brown spots; side of head with narrow brown lines and brown spots; dorsal and anal pale; caudal brown, crossed by a pale bar near middle, which is followed by a dark bar; tip of tail with a green border. In alcohol, the body and head become grayish or blackish; an irregular black blotch behind gill-opening; fins all pale, traces of bars on caudal remaining. In the young there are no spines on tail.

From the West Indies to coast of Brazil, and occasionally north to Florida. It has been recorded from the Florida Keys and the Tortugas; also from Cuba and Bahia. Probably not abundant in Porto Rico; two obtained at Arroyo, each 7 inches long; others seen. It reaches a weight of 6 pounds.

Lija colorada, Parra, Dif. Piezas, etc., pl. 23, 1787, Cuba.
Monacanthus pullus Ranzani, Nov. Comm. Act. Sci. Inst. Bonon., V, 4, pl. 1, 1842, Brazil.
Monacanthus pardalis, Günther, Cat., VIII, 230, 1870; in part, probably not of Rüppell.
Monacanthus ruppelii Castelnau, Anim. Nouv. Amér. Sud, Poiss., 97, pl. 47, fig. 2, Bahia.
Monacanthus macrocerus Hollard, Ann. Sci. Nat. 1854, 4th series, II, 327, pl. 12, fig. 1, 1854; Bahia, adult.
Monacanthus irroratus Poey, Memorias, II, 330, 1861, Cuba.
Monacanthus stratus Poey, Memorias, II, 329, 1861, Cuba.
Monacanthus parraianus Poey, Proc. Ac. Nat. Sci. Phila. 1863, 185, Cuba; after *Lija Colorada* of Parra.
Monacanthus punctatus Poey, Synopsis, 437, 1868, Cuba.
Cantherines pullus, Jordan & Evermann, l. c., 1713, 1898.

Genus 120. MONACANTHUS Cuvier.

Body short and deep, very strongly compressed, covered with minute, rough scales. Mouth very small; upper jaw with a double series of incisor-like teeth, usually 6 in outer and 4 in inner series; lower jaw with about 6 incisors in a single series; teeth connivent, unequal; gill-opening a small slit, shorter than eye, nearly vertical below posterior part of eye and just in front of upper edge of pectoral. Dorsal spine large, armed with two series of retrorse barbs, no conspicuous filaments; second dorsal and anal fins similar to each other, of about 25 to 35 rays each; caudal fin moderate, rounded; pelvic bone with a blunt, movable spine, bone connected by a movable flap of varying size; side of tail often with a patch of spines, especially in males. Vertebræ 7 + 11 to 14 = 18 to 21.

Species very numerous, in warm seas; most of them small, lean fishes with leathery skin and bitter flesh, unsuited for food.

MONACANTHUS:
  a. Ventral flap in adult greatly developed, extending much beyond ventral spine; adult with 2 or 3 pairs of recurved spines on caudal peduncle; young without these characters, similar to young of *Stephanolepis*.
  b. D. I, 30; A. 30. Color very variable .... *ciliatus*, 216
STEPHANOLEPIS:
  aa. Ventral flap, even in adult, moderately developed, not reaching beyond pelvic spine; no recurved spines on caudal peduncle.
  c. Dorsal and anal each with 30 to 32 soft rays.
  d. Depth more than half length of body .... *hispidus*, 217
  dd. Depth less than half length of body .... *spilonotus*
  cc. Dorsal and anal each with about 27 soft rays .... *oppositus*

216. Monacanthus ciliatus (Mitchill). *Leather-fish; Lija; "Pez de Puerco."*

Head 3.5; depth 1.75; young 1.5; D. I, 30; A. 30; scales very small, without median crest. Spines becoming longer on caudal peduncle, which has in addition 2 or 3 pairs of strong spines curved forward, these prominent only in adults; ventral flap longer than head, about one-third length of body. Scales on ventral flap developed as flat plates, with their free margins pectinate. Snout pointed, upper profile concave. Dorsal spine strong, nearly as long as head, armed behind with 2 rows of retrorse barbs; ventral spine small, rough.

Color varying very much with the surroundings of the fish, from dull olive-gray to the most vivid grass-green; markings not well defined and not very constant; green, with white cirri on sides; a whitish longitudinal cloud behind pectoral; a pale band downward and forward from eye; lower side of head with darker crossbands; dorsal and anal pinkish, with (usually 3) darker spots at base; ventral flap edged with scarlet; caudal greenish, mottled with darker and pale; some specimens show neither red nor green shades, and have vague, dusky, longitudinal stripes. A specimen 3 inches long, from Isabel Segunda, Vieques Island, in alcohol, is brownish-gray, dusky, with a large black clouded blotch from front of soft dorsal downward and forward to middle of side; body irregularly clouded with dusky elsewhere; top of head brownish-gray; below very dusky, becoming black on flap, which has a light submarginal stripe followed by a narrow white border; dorsal and anal translucent; a faint dark blotch below middle of soft dorsal, and one at front of anal; caudal barred with white and dark.

This species is known from the West Indies and southern Florida, and is very abundant about the Florida Keys, along with *M. hispidus*. It has been recorded also from Bahamas, Puerto Cabello (Cuba), Jamaica, and Porto Rico, where it is not uncommon. Our collection contains specimens from San Geronimo, Boqueron, Guanica, and Isabel Segunda, off Vieques Island, where a specimen was dredged in 16 fathoms at station 6092, and off St. Thomas, at station 6079, in 20 to 23 fathoms. Length 3 to 8 inches. The young of this species and of *M. hispidus* are much alike, but *M. ciliatus* is always more elongate, and as it grows older the pelvic flap grows much larger and the armature of the tail more distinct.

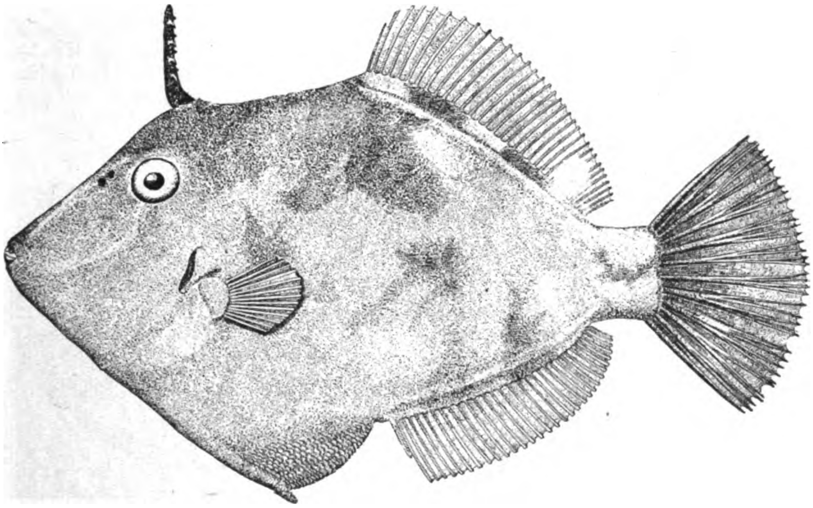

FIG. 71.—*Monacanthus ciliatus.*

Balistes ciliatus Mitchill, Amer. Monthly Mag. and Crit. Rev., March, 1818, 326, Bahama Straits.
Monacanthus occidentalis Günther, Cat., VIII, 237, 1870, Puerto Cabello, Cuba.
Monacanthus davidsoni Cope, Trans. Amer. Phil. Soc. Phila., XIV, 1870, 476, Florida Reef.
Monacanthus ciliatus, Jordan & Evermann, l. c., 1714, 1898.

217. Monacanthus hispidus (Linnæus). *Fool-fish; File-fish; Leather-fish; Horny Cony; Lija.*

Head 3.4; depth 1.75; D. I, 32; A. 32. Young slightly deeper (1.5) proportionally than adult. Body rather deep. Jaws subequal; eye large, about 3 in snout. Gill-opening about as long as eye, separated from eye by an interspace nearly equal to its length. Anterior profile slightly concave. Dorsal spine somewhat shorter than snout, more than half head, inserted above posterior part of eye, stout, rough, armed behind with 2 rows of retrorse barbs; first ray of soft dorsal often filamentous in adult (male?), its length varying from that of snout to that of depth of body (longest among specimens seen by us is one from Canary Islands); pectoral small. Pelvic bone long, ending in a short, blunt, movable spine, beyond which the abdominal flap does not extend. Scales minute, each with a crest of about 3 prickles, those on caudal peduncle villous, those on ventral flap larger, elongate; no naked areas; no recurved spines on tail. Length 10 inches.

Color, grass-green or olive; back and sides with faint, irregular whitish spots; head plain; spinous dorsal and caudal green; second dorsal and anal translucent; adult less variegated; dull olivaceous, mottled with dusky.

This species ranges from Cape Cod to Cuba, and is abundant on our South Atlantic coast and among the Florida Keys, and southward, through the West Indies to Brazil. It is recorded by Jordan & Rutter from Jamaica, where it is called "mingo"; known from Key West, the Pensacola snapper-grounds, Big Gasparilla, and the Anclote Sponge Kraals; apparently not common in Porto Rico, as the collection contains but a single small specimen seined at Boqueron and five larger ones from Puerto Real.

Balistes hispidus Linnæus, Syst. Nat., ed. XII, 405, 1766, Carolina.
Balistes broccus Mitchill, Trans. Lit. and Phil. Soc., I, 1815, 467, New York.
Monacanthus filamentosus Valenciennes, Îles Canaries, 95, 1836, Canaries; adult.
Monacanthus gallinula Valenciennes, l. c., 95, Canaries; young.
Monacanthus varius Ranzani, Nov. Comm. Bonon., V, 6, 1842, Brazil.
Monacanthus massachusettensis De Kay, N. Y. Fauna: Fishes, 337, pl. 57, fig. 187, 1842, Massachusetts Bay.
Monacanthus setifer De Kay, N. Y. Fauna: Fishes, 337, pl. 59, fig. 194, 1842, New York Harbor; probably not of Bennett.
Monacanthus signifer Storer, Synopsis Fishes N. A., 497, 1846, Massachusetts; substitute for *setifer*, preoccupied.
Monacanthus hispidus, Jordan & Evermann, l. c., 1715, 1898.

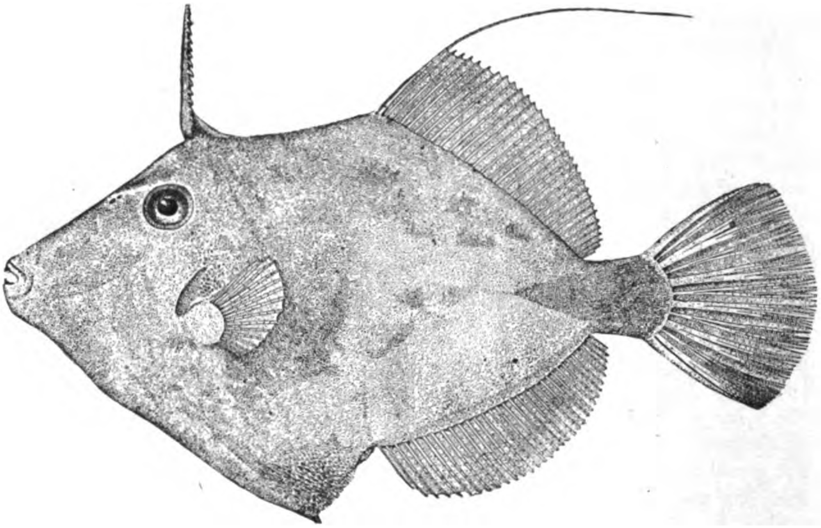

FIG. 72.—*Monacanthus hispidus*.

Genus 121. ALUTERA Cuvier. File-fishes.

Body oblong or rather elongate, strongly compressed, covered with minute rough scales. Mouth and teeth essentially as in *Monacanthus*, but lower jaw more projecting, so that the lower teeth are directed obliquely upward and backward. Gill-opening an oblique slit, longer than eye, situated below and in advance of eye, its posterior end behind base of pectoral. Pelvic bone long, falcate, movable under skin, without spine at its extremity. Dorsal spine small, inserted over eye, rough, but without barbs; soft dorsal and anal long, each of 36 to 50 rays; caudal fin convex; pectoral small. Species numerous.

CERATACANTHUS:
- *a.* Dorsal rays I, 36.
  - *b.* Anal rays 38; coloration nearly uniform .... *schœpfii*
  - *bb.* Anal rays 38; body covered with small, round dark-brown spots .... *punctata*
- *aa.* Dorsal rays about I, 46; anal rays about 50.

OSBECKIA:
  - *c.* Caudal fin elongate, with rounded angles. Coloration not uniform, head and body with irregular blue spots and lines, besides small round black spots; upper profile of snout concave .... *scripta*, 218

ALUTERA:
  - *cc.* Caudal fin short, subtruncate, with acute angles. Coloration uniform; upper profile of snout convex... *monoceros*

218. Alutera scripta (Osbeck). *Unicorn-fish; Lija Trompa.*

Depth 3 to 3.25; D. I, 44 to 48; A. 47 to 52; vertebræ 7+14. Body oblong, its depth being nearly equal to distance of hind margin of orbit from extremity of snout; snout produced, with upper profile concave; dorsal spine long and slender, above middle of orbit, about 1.25 in head; middle of gill-opening in advance of middle of eye; pectoral fin below posterior part of eye; caudal fin elongate, nearly as long as, or longer than, head, rounded; dorsal and anal fins low; ventral spine none. Head and body olivaceous, with irregular light-blue spots and curved streaks; besides these, numerous round black spots about as large as pupil; dorsal and anal yellowish; caudal reddish; skin finely velvety.

An inhabitant of tropical seas. Common in the West Indies, occasionally northward to South Carolina; also occasionally taken about the islands off the west coast of Mexico. Not seen by us in Porto Rico, but recorded from there by Professor Poey. Length 2 to 3 feet.

Unicornu pisces bahamensis (the Unicorn-fish) Catesby, Hist. Nat. Carolina, etc., II, pl. 19, 1737, Bahamas.
Balistes scriptus Osbeck, Iter Chin., I, 144, 1757, China.
Lija trompa Parra, Dif. Piezas Hist. Nat., 46, pl. 22, fig. 1.
Balistes lævis Bloch, Ichthyol., IX, 82, pl. 414, 1795, Morocco; Tranquebar.
Balistes ornatus Marion de Procé, Bull. Soc. Philom., 131, 1822.
Aluteres parera Lesson, Voy. Coquille, Zoöl., 106, 1828.
Monacanthus proboscideus Ranzani, Nov. Comm. Ac. Sc. Inst. Bonon., 1842, 8, Brazil.
Aluterus venosus Hollard, Ann. Sc. Nat., IV, 1855, 14, pl. 1, fig. 3.
Alutera picturata Poey, Proc. Ac. Nat. Sci. Phila. 1863, 183, Cuba.
Alutera scripta, Poey, Fauna Puerto-Riqueña, 345, 1881; Jordan & Evermann, l. c., 1719, 1898.

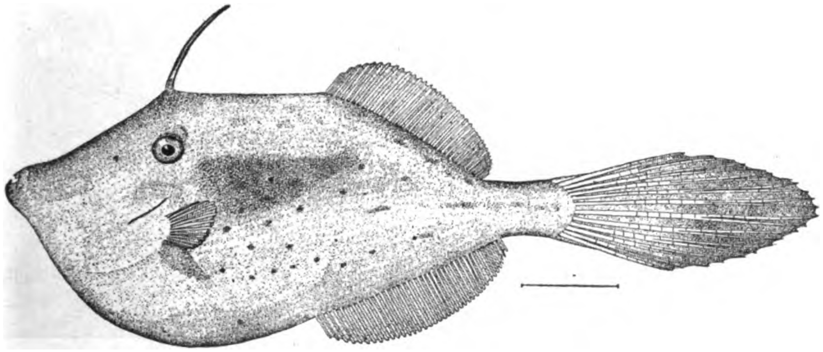

FIG. 73.—*Alutera scripta.*

Family LVIII. OSTRACIIDÆ. The Trunk-fishes.

Body short, cuboid, triquetrous or pentagonal, covered by a carapace formed of firmly united polygonal bony patches; jaws, bases of fins, and caudal peduncle free and covered by smooth skin. Mouth small; each jaw with a single series of long, narrow teeth. Maxillaries and premaxillaries firmly united. Gill-opening a nearly vertical slit, below and behind eye. Dorsal fin single, short, without spine; anal short, similar to dorsal; caudal rounded; no ventral fins; vertebræ 14, the anterior 9 elongate, the last 5 extremely short; no ribs.

The *Ostraciidæ* comprise 3 genera and about 20 species, all of the tropical seas, living near bottom in shallow waters. The species are so singular in appearance and so easily preserved that they have been common in collections ever since the collecting of tropical curiosities began. The 4 American species were well known to Artedi and Linnæus. Goode says of these fishes:

"The locomotion of the trunk-fishes is very peculiar. The propelling force is exerted by the dorsal and anal fins, which have a half-rotary, sculling motion, resembling that of a screw propeller; the caudal fin acts as a rudder, save when it is needed for unusually rapid swimming, when it is used as in other fishes; the chief function of the broad pectorals seems to be that of forming a current of water through the gills, thus aiding respiration, which would otherwise be difficult on account of the narrowness and inflexibility of the branchial apertures. When taken from the water one of these fishes will live for two or three hours, all the time solemnly fanning its gills, and when restored to its native element seems none the worse for its experience, except that, on account of the air absorbed, it can not at once sink to the bottom."

Genus 122. LACTOPHRYS Swainson. Three-angled Trunk-fishes.

Trunk-fishes with carapace 3-angled, ventral surface flat or concave, never carinate; carapace closed behind anal fin; carapace with or without frontal and abdominal spines; dorsal rays 9 or 10; caudal rays always 10. This genus contains 5 species, 4 of them American, and differs from the Old World genus *Ostracion* only in form of carapace. The median dorsal ridge of carapace is much more developed than the others, so that the body is 3-sided and 3-angled, instead of 4-sided and 4-angled, as in *Ostracion*. Although this character is a striking one, it is not one of high structural importance. Holland and Bleeker have discarded it as being of no real systematic value. All writers agree that the species of the group are most closely related, and that the relations of the species are closer than they appear. We think, with Dr. Goode, that the shape of the carapace affords "the most reliable guide in the arrangement of the species of the genus," and we think it not improper to accord generic distinction to the 3-angled species, as distinct from the more specialized 4-angled forms.

RHINESOMUS:
  a. Carapace without spines anywhere .... *triqueter*, 219
  aa. Carapace with distinct spines, at least on the ventral ridges behind.
  b. Frontal spines none.
CHAPINUS:
  c. Carapace closed behind dorsal fin; body everywhere with round, dark spots .... *bicaudalis*, 220
LACTOPHRYS:
  cc. Carapace open behind dorsal fin; body mottled with paler .... *trigonus*, 221
ACANTHOSTRACION:
  bb. Frontal region with 2 strong spines like horns .... *tricornis*, 222

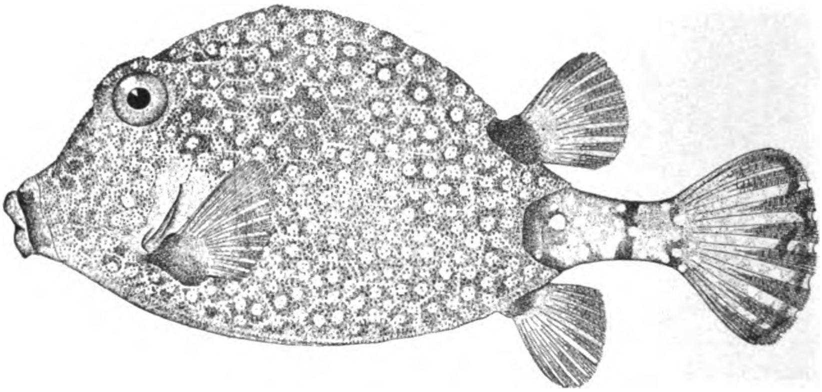

FIG. 74.—*Lactophrys triqueter.*

219. Lactophrys triqueter (Linnæus). "*Chapin*": *Trunk-fish.*

Head 3.5; height of side about 2; greatest ventral width 2.6; eye 3.4; snout 1.4; interorbital 1.7; least depth of caudal peduncle 4.1, its width in its depth 2.5; D. 10, its base 3.7 in head, the height 1.6; A. 10, its base equal to that of dorsal, its height a little less; P. 11 or 12, 1.6 in head. Body sharply 3-angled, sides rather double concave; dorsal carina strongly arched, more so than in *L. bicaudalis*, ending anteriorly above eye; ventral angles more convex and flaring than in *L. bicaudalis*; supraoccipital ridge less strong, continued backward along side in a low, flat ridge; profile from snout to eye somewhat concave; interorbital space concave; ventral surface slightly convex anteriorly, posteriorly with two low ridges, the surface between them and between each and the ventral angle shallowly concave; scales of sides hexagonal, in young with striæ radiating from center to angles of each scale, in adults armed simply with tubercles, 9 or 10 plates in horizontal series from gill-opening to tail, 8 in median line of ventral surface, 8 between ventral keel and back; posterior dorsal scute unarmed; carapace closed behind dorsal and anal, width behind dorsal about 1.75 that behind anal; carapace without spines anywhere; branchial aperture oblique, its length about 2.5 in head, greater than eye; dorsal, anal, and caudal obtusely rounded; pectoral triangular, first rays longest.

Color in life: Body dirty white, upper third with small round white spots and some narrow black bars promiscuously arranged; head whiter and with whiter stellate spots; ventral angles with some white spots; ventral surface plain pale; opercular opening bordered in front by brown, then black, and behind by black; base of pectoral and dorsal black, the fin pale yellow; caudal peduncle black with many round white spots; base of caudal similarly marked; caudal dirty white with numerous large irregular black spots. In spirits dark brown, thickly covered with circular spots of yellowish-white; ventral surface lighter and without spots; lips, bases of fins, border of branchial opening, and caudal peduncle black, or brown like ground-color of body; caudal peduncle with numerous small round white spots; caudal dusky, the tip black; other fins plain.

Found among the West Indies north to the Bermudas, Key West, and Pensacola; generally very common in the Tropics; common about Porto Rico, the collection containing specimens from Arroyo, Isabel Segunda, Culebra, and Puerto Real. A sluggish fish, reaching a foot in length, living on the bottom about reefs and among algæ, feeding on minute animals of various kinds.

Ostracion polyodon inermis triqueter Linnæus, Adolphi-Frederici, I, 60, 1754, India.
Ostracion triqueter Linnæus, Syst. Nat., ed. X, 330, 1758, India; after Mus. Ad. Fr.
Ostracion concatenatus Bloch, Ichthyol., pl. 131, 1785, Martinique; on a painting by Plumier.
Lactophrys triqueter, Jordan & Evermann, l. c., 1722, 1898.

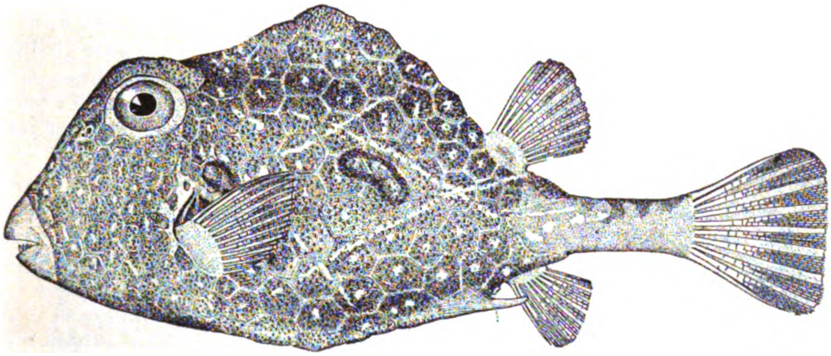

FIG. 75.—*Lactophrys trigonus.*

220. Lactophrys trigonus (Linnæus). *"Chapin"; Common Trunk-fish.*

Head 2.9; height of side 1.7; greatest ventral width 1.75; width between ventral spines 3.5; eye 2.8; snout 1.3; interorbital 1.8; D. 10, its base 4.25 in head, 1.5 in eye or 2 in height of fin; A. 10, its base and height about equal to dorsal; P. 2 in head. Body 3-angled, ventral angles strongly convex and strongly flaring; dorsal carina strongly and regularly arched, ending anteriorly above posterior border of orbit; supraoccipital ridge strong; interorbital space concave; profile from snout to eye nearly straight, a slight angle; carapace open behind dorsal, closed behind anal; caudal peduncle slender, its length 1.6 in head, its least depth 2.9 in its length, its least width 2 in its depth. Scales of sides hexagonal, covered with small tubercles.

Color, olive-gray, a faint blue spot in center of each of most of the scales; nostril in a yellow spot; boundaries of upper scutes blackish, of lower bluish; scutes behind gill-opening black, surrounding a white center, forming a large black blotch; a similar blotch on side between eye and base of caudal peduncle; caudal peduncle pale-olivaceous, with a few obscure white spots; fins all pale except caudal, which is somewhat dusky, especially at tip.

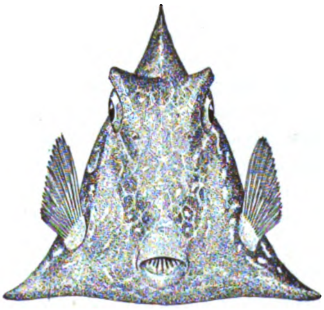

FIG. 76.—*Lactophrys trigonus;* front view.

An inhabitant of the West Indies, north to the Bermudas and Florida, occasionally in the Gulf Stream to Woods Hole and Chesapeake Bay; common on the coast of Florida; recorded by Jordan & Rutter from Jamaica; apparently not common in Porto Rico, only one specimen, 3 inches long, having been obtained, at San Antonio Bridge. It reaches a length of about a foot.

Ostracion triangulatus lenibis figurararum hexagonarum eminentibus, etc., Artedi, Genera, 56, 1738, Jamaica; seen by Artedi in the collection of Sir Hans Sloane and in the Naggs Head Inn, London.

Ostracion trigonus Linnæus, Syst. Nat., ed. X, 330, 1758, India; after Artedi.

Ostracion yalei Storer, Bost. Journ. Nat. Hist., I, 1837, 353, Holmes Hole, on Marthas Vineyard.

Lactophrys oviceps Kaup, Archiv Naturg. 1855, 218; specimens with 10 dorsal rays, Linnæus having given by error "D. 14" in the original description of *O. trigonus*.

Ostracion undulatus Poey, Synopsis, 441, 1868, Havana.

Ostracion expansum Cope, Trans. Am. Phil. Soc. 1870, 474, figs. 9–10, St. Martins, West Indies.

Lactophrys trigonus, Poey, Fauna Puerto-Riqueña, 347, 1881; Stahl, l. c., 81 and 167, 1883; Jordan & Evermann, l. c., 1723, 1898.

221. **Lactophrys bicaudalis** (Linnæus). "*Chapin*"; *Spotted Trunk-fish.*

(PLATE 40.)

Head 3.5; height of side 2.25; greatest ventral width 2.7; width between bases of ventral spines 3.6; eye 3; snout 1.3; interorbital 2.1; least depth of caudal peduncle 3.4; its width in its depth 3.2; D. 10, base of fin 4 in head, the height 2; A. 10, its base and height equal to dorsal; P. 12, 1.8 in head. Body sharply 3-angled, sides and ventral surface posteriorly somewhat concave; dorsal carina sharp, considerably arched, ending in front over middle of eye; supraocular ridges strong, a slight ridge from supraocular ridge along side to caudal peduncle; no spines on head; a sharp, stiff spine, 3.4 in head, on each side at posterior angle of ventral surface; carapace closed behind dorsal and anal fins, its width behind dorsal about twice that of strip behind anal; caudal peduncle about 1.4 to 1.6 in head; branchial aperture oblique, short, about 3.6 in head; body and head everywhere rough, tuberculate, tubercles strongest on body; hexagonal plates best defined on ventral surface.

Ground-color, light-yellowish, changing to whitish below; everywhere on head, body, caudal peduncle, and caudal covered with small round black spots, largest on middle of side, where they are somewhat smaller than pupil, those on the caudal peduncle small, larger on caudal fin, arranged in 5 to 7 irregular vertical bars; tip of snout rose, with a few small black spots above fleshy base of dorsal; pectoral with several black spots, few or none upon anal; pupil black, with orange border. In spirits 3 to 5 irregular white blotches in center of hexagonal plates on low ridge behind eye.

An inhabitant of the West Indies, generally common from Cuba to Ascension Island; not known from Florida; recorded by Jordan & Rutter from Jamaica; next to *L. trigonus* the least common species of the genus about Porto Rico, specimens having been obtained only at Ensenada del Boqueron, Ponce, and Arroyo. It reaches a length of a foot or more.

Ostracion triangulatus tuberculis hexagonis radiatis, etc., Artedi, Genera, 57, 1738, India.

Ostracion bicaudalis Linnæus, Syst. Nat., X., 330, 1758, India.

Lactophrys bicaudalis, Jordan & Evermann, l. c., 1723, 1898.

222. **Lactophrys tricornis** (Linnæus). *Toro; Cow-fish.*

Head 4.25; height of side 2.5; greatest ventral width 4.8; width between ventral spines 8.3; eye 2.7; snout 1.25; interorbital 2; D. 10, base equal to eye, height nearly equal to head; anal base 1.25 in eye, height 2 in head; caudal long, equal to distance from tip of snout to posterior edge of pectoral base; pectoral 1.2 in head; caudal peduncle long and slender, length a little exceeding that of head, least depth 2.75 in its length, least width about 3 in its least depth. Body 3-angled; dorsal carina gently arched, beginning over posterior part of pupil; ventral angles not flaring nor wide apart, each ending posteriorly in a stout spine; supraoccipital ridge moderate, with a stout spine in front; middle of side with a broad low ridge from eye to caudal peduncle; snout projecting, outline from snout to occipital spines concave below, then rising abruptly; interorbital very convex; gill-opening oblique, short, scarcely equal to eye; carapace closed behind dorsal and anal fins, the width of part behind dorsal about four times that behind anal, plate behind dorsal sometimes ending in a short spine, directed upward; hexagonal plates with small, blunt tubercles. Occasional specimens have a real spine on supracaudal plate, as figured by Lister. Of nine Porto Rican specimens examined by us two have this spine.

Color, brown, yellow, blue, or green, with irregular blue blotches, centers of scutes often lighter than margins. Young light gray, tinged with olive; belly white; head and carapace with round spots of light-blue, these sometimes forming more or less interrupted longitudinal stripes; about four of these stripes on cheek; tail above with blue, brown-edged spots; dorsal olive, its base blackish; caudal olive, edged and mottled with light blue; anal similar; pectoral olive.

Found in the tropical Atlantic; very common from the Carolinas to Brazil. Recorded from several Florida localities and common in Jamaica and Porto Rico, specimens being at hand from Puerto Real, Ensenada del Boqueron, Ponce, Arroyo, and Isabel Segunda. The four species of trunk-fishes found in our waters have the same general habits. They are all slow and sluggish, and are found on sandy bottom where there are open or naked areas surrounded by patches of algæ. They seem peculiarly susceptible to cold, and on the Florida coast large numbers are frequently washed up on the shore that have apparently been killed by a sudden fall in the temperature.

Piscis triangularis capiti cornutus cui e media cauda cutanea aculeus longus erigitus, Lister, in Willughby, Hist. Pisc., Appendix, 19, 1686; locality not given.

Ostracion triangulatus aculeis duobus in capite et unico longiore superne ad caudam, Artedi, Genera, part 3, 56, 1738; after Lister in Willughby.

Ostracion triangulatus duobus aculeis in fronte et totidem in imo ventre, Artedi, Genera, part 3, 56, 1738; specimens seen in London at the house of Mr. Lillja and in the Naggs Head Inn.

Ostracion tricornis Linnæus, Syst. Nat., ed. X, 331, 1758; after Artedi.

Ostracium quadricornis Linnæus, Syst. Nat., ed. X, 331, 1758; after Artedi.

Ostracion listeri Lacépède, Hist. Nat. Poiss., I, 468, 1798; after Willughby.

Ostracion sexcornutus, Mitchill, Amer. Monthly Mag., II, 1818, 328, mouth of Mississippi River.

Ostracion maculatus Hollard, Ann. Sci. Nat. 1857, 149.

Ostracion guineensis Bleeker, Ned. Tydskr. Dierk, II, 298, Guinea.

Ostracion gronovii Bleeker, Ned. Tydskr. Dierk, II, 298.

Acanthostracion polygonius Poey, Enumeratio, 175, 1876, Cuba.

Acanthostracion quadricorne, Stahl, l. c., 167, 1883.

Lactophrys tricornis, Jordan & Evermann, l. c., 1724, 1898.

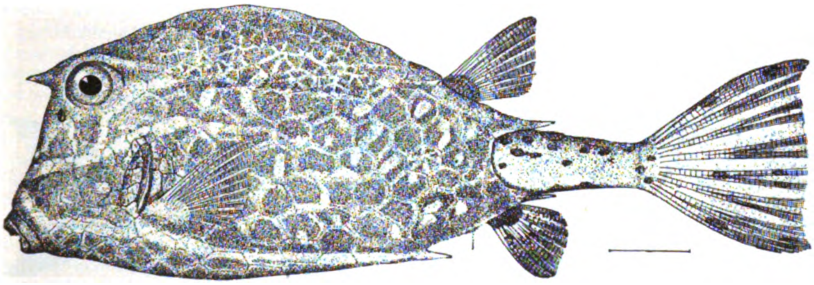

FIG. 77.—*Lactophrys tricornis.*

Family LIX. TETRAODONTIDÆ. The Puffers.

Body oblong or elongate, usually little compressed, sometimes very broad; head and snout broad; belly capable of great inflation; skin scaleless, usually more or less prickly, spines or prickles usually weak and movable, not rooted; in one genus (*Ephippion*) the skin is armed with bony scutes forming a sort of carapace, approaching that seen in *Ostracion;* teeth confluent, forming a sort of beak which in each jaw is divided by a median suture; maxillaries curved outward behind premaxillaries; lips full; nostrils various. Spinous dorsal and ventral fins wanting, fins composed of soft rays only; dorsal fin posterior, opposite and similar to anal; caudal fin distinct; no ventral fins, pelvic bone undeveloped; no ribs; pectoral fins short and broad, upper rays longest; caudal fin and its vertebræ normally developed. Medifrontals articulated with supraoccipital, postfrontals confined to sides, ethmoid more or less projecting in front of frontals; postfrontals extending outward as far as frontals; prosethmoid short and narrow, little prominent to view above; vertebræ few, 7 or 8 + 9 to 13. Gill-openings small, placed close in front of pectorals; air-bladder present.

There are about 10 genera and 60 species of this family inhabiting warm seas and found on soft or sandy bottom where there is some vegetation. They are sluggish in movement and noted for their habit of filling the stomach with air. When disturbed they then float on the surface, belly upward. Not used as food, the flesh being ill-flavored and reputed poisonous. None of them over 12 or 15 inches in length.

TETRAODONTINÆ:

a. Frontal bones expanded sidewise and forming lateral roofs of orbits, postfrontals limited to posterior portions. Species chiefly marine.

b. Nostril on each side with two distinct openings; frontal region longer than broad.

c. Dorsal and anal fins comparatively long, falcate, each of 12 to 15 rays; nostrils sessile, or nearly so, not forming a distinct papilla; mucous tubes on upper part of head and on sides of body very conspicuous. LAGOCEPHALUS, 123

cc. Dorsal and anal fins comparatively short, rounded, each of 6 to 8 rays; nostrils at summit of a hollow, simple (or lobed) papilla; mucous tubes inconspicuous.......... SPHEROIDES, 124

COLOMESINÆ:

aa. Frontal bones narrowed and excluded from orbit; postfrontals being elongated and projected forward and connected with prefrontals; dorsal and anal fins short, rounded; snout very obtuse; vertebræ $8 + 11 = 19$; nostrils (probably) as in *Spheroides*. Fluviatile species.......... COLOMESUS

Genus 123. LAGOCEPHALUS Swainson.

Body comparatively elongate; skin smooth or variously prickly, prickles most developed on abdomen; abdomen capable of very great inflation. Dorsal and anal rather long, falcate, 12 to 15 rays each; caudal lunate. Nostril without distinct papilla, each with two distinct openings; mucous tubes on upper part of head and on sides of body very conspicuous. Lower side of tail with a fold.

The fishes of this genus are chiefly tropical, *Lagocephalus lagocephalus* reaching the coasts of southern Europe. Vertebræ about $8 + 13 = 21$. The increased number of vertebræ and of rays in vertical fins mark a transition toward the allied family, *Chonerhinidæ*, in which there are about 29 vertebræ, the dorsal rays about 35, the anal 30.

a. Body elongate; head 3.25 in length; depth 4.25.......... *lævigatus*, 223

aa. Body stout; head 2.8 in length; depth 3.5.......... *pachycephalus*

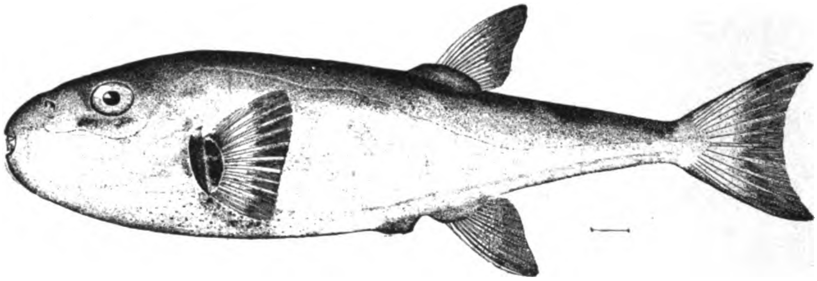

FIG. 78.—*Lagocephalus lævigatus.*

223. Lagocephalus lævigatus (Linnæus). *Smooth Puffer; "Tamboril"; "Conejo."*

Head 3.3; depth 4.3; eye 4.8; snout 2.1; interorbital 2.3; D. 13; A. 12; pectoral 2; caudal 1.25. Body elongate, robust, caudal peduncle long and slender, abdomen greatly distensible and set with short spines which are depressed when abdomen is deflated, skin elsewhere smooth; head large and blunt; upper jaw with two great broad confluent incisor teeth with a median suture; lower teeth much smaller; side of body separated from belly by a ridge or angle; lines of mucous pores around eye and on top of head armed with weak spines; caudal lunate.

Color in spirits: Purple above, nearly black; side dirty-silvery, belly white. The young have three broad, dark, transverse bands on back of trunk, one on peduncle, one through base of dorsal, and one opposite pectoral; similar narrower bands on top of head.

The smooth puffer is a large, sluggish fish, reaching a length of 2 feet, and of no value as food. It is found in bays and river mouths from Cape Cod to Brazil; it is common southward, but rather rare north of Cape Hatteras; recorded from New York, Chesapeake Bay, Charleston, Biscayne Bay, Key West, Pensacola, St. Johns River, Tortugas, Cuba, and Jamaica. Found by us at Palo Seco and Mayaguez, most of our specimens being young, only 2.5 to 4 inches long.

Ostracion cathetoplateo oblongus, Artedi, Genera Piscium, genus 58, species 13, 1738; after *orbis lagocephalus*, Grew, etc.
Tetrodon lævigatus Linnæus, Syst. Nat., ed. XII, 411, 1766, Charleston, S. C.; Poey, Fauna Puerto-Riqueña, 366, 1881; Stahl, l. c., 81 and 167, 1883.
Tetrodon curvus Mitchill, Trans. Lit. and Philos. Soc., I, 1815, 474, New York; young.
Tetrodon mathematicus Mitchill, Trans. Lit. and Philos. Soc., I, 1815, 474, New York.
Tetrodon pachycephalus, Ranzani, Nov. Comm. Ac. Sci. Inst. Bonon., IV, 73, pl. 11, fig. 2, 1840, Brazil.
Holacanthus melanothus Gronow, Syst. Nat., ed. Gray, 24, 1854, Carolina; based on *Tetrodon lævigatus* of Linnæus.
Tetrodon lineolatus Poey, Synopsis, 432, 1868, Cuba; young.
Lagocephalus lævigatus, Jordan & Evermann, l. c., 1728, 1898.

Genus 124. SPHEROIDES Lacépède. Swell-fishes.

Body oblong, not elongate; skin variously prickly or smooth, sometimes with cirri. A single, short, simple nasal tube on each side, with 2 rather large openings near its tip. Dorsal and anal fins short, little falcate, of 6 to 8 rays each; caudal truncate or rounded, rarely slightly concave. Vertebræ 8+10=18. Frontal bones expanded sidewise and forming lateral roof of orbit, postfrontals limited to posterior portions.

Species numerous, in warm seas; largely American. Our species represent two well-marked subgenera, the extremes of which appear very different from each other so far as the skulls are concerned. Some typical species of *Spheroides* approach *Canthigaster* in narrowness of frontal area.

SPHEROIDES:

a. Skull very narrow above, interorbital area more or less concave, 2.5 to 6.5 times in length of long snout, 5 to 12 times in head; sides of body usually with small dermal flaps.
b. Interorbital space flat or moderately concave; no dorsal flaps; back without curved cross-streaks; upper ray of caudal produced.
c. Sides of head and body always smooth except sometimes a strip behind pectoral; spines larger, higher, more stellate, wider apart than in *Spheroides maculatus*, irregularly placed and often wholly wanting; side usually with small dermal slips or flaps, especially in the young.
d. Lower part of side with a series of about 12 round black spots; caudal fin barred with black and white.. *spengleri*, 224
dd. Lower part of side with a series of black blotches appearing as short vertical bars (never round); caudal fin not barred .... *nephelus*
cc. Sides of head and body always prickly, as is back from upper lip to base of dorsal; belly prickly, prickles all similar, small, 3-rooted, stiff and close-set, never obsolete; no cirri; back with dark spots; black blotches on sides forming short oblique crossbars, those behind pectoral most conspicuous; caudal nearly plain, darker at tip.
e. Color dark-brown, with black blotches; a series of about a dozen irregular black spots along under side.. *maculatus*
ee. Color dark, olivaceous above; black blotches on lower part of sides in form of short, oblique crossbars.. *marmoratus*, 225

CHEILICHTHYS:

aa. Skull very broad above, interorbital space broad, flattish, or very little concave, its width more than half snout and 2.66 to 4 in head; sides without series of dark blotches bounding line of belly.
f. Caudal fin rounded or subtruncate; back and sides with many small irregular black spots; no series of larger blotches bounding edge of belly.
g. Dark shades on back, broad, appearing as ground-color and crossed by pale curved crossbars and streaks forming arcs of concentric circles, these sometimes broken by reticulations everywhere profusely spotted with black in adult; snout somewhat produced .... *testudineus*, 226
ff. Caudal fin lunate or truncate, with angles acute or produced.
h. Dorsal rays 8; body more or less prickly, above and below; color brownish above, vermiculated with paler; eye broader than interorbital space (in young of 4 inches) .... *trichocephalus*
hh. Dorsal rays 10; body (in adult) everywhere perfectly smooth; interorbital space broad, equal to snout and twice diameter of eye; brown, with darker spots above .... *pachygaster*

224. Spheroides spengleri (Bloch). *Southern Puffer; Swell Toad; Tambor; "Tamboril."*

Head 2.38; eye 5; snout 2; interorbital 7; D. 7. Head compressed, long; snout very long, profile from tip of snout to above eye rising gradually, slightly concave in front of eye; interorbital space narrow, concave, slightly wider than in *S. nephelus;* posterior part of body usually smooth, with a number of small white dermal flaps; anterior part of body usually covered with small stiff prickles; region back of eyes and between pectorals and entire under-parts from throat nearly to anal fin prickly, those underneath strongest; head wholly naked above, a few weak prickles on cheek and a few on posterior part of throat.

Color in alcohol: Dark grayish-brown above on head and body, thickly covered and mottled with black or brown spots and paler areas, spots often grouped, forming blotches; under parts white; tip of chin pale, behind and on sides of which is a broad dusky border; dark of side bordered below by a line of about 12 round black spots, varying somewhat in size, but averaging about size of pupil and iris; pectoral, dorsal, and anal pale; caudal rather distinctly barred, a broad dark bar at base, then a somewhat broader pale bar, next another broad darkish bar, tip of fin pale.

The current descriptions of *S. spengleri* have been based partly on specimens of *S. nephelus*, an entirely distinct species, which has been confused with the present one. The two species differ markedly in the very differently-shaped head and coloration. In *S. spengleri* the head is more slender, snout much longer, profile less steep and less concave, and the interorbital somewhat wider. The color of *S. nephelus* resembles that of *S. marmoratus*, as does also its shape; the spots along side in *S. spengleri* are usually nearly round, while in *S. nephelus* they are never round, but are oblong or short vertical bars invading the white of lower parts from the dark side; the spots in *S. spengleri* are always more distinct and the caudal fin is always barred, a character which may be regarded as diagnostic.

An inhabitant of the West Indies, north to Florida; recorded from Tortugas, Key West, Garden Key, Biscayne Bay, Big Gasparilla, and Tampa; also from Cuba and Martinique; common about Porto Rico, specimens having been obtained at San Antonio Bridge, Puerto Real, Fajardo, Culebra, and San Geronimo; most of the specimens are small, but the fish attains a length of about a foot.

Tetrodon spengleri Bloch, Ichthyologia, I, 135, pl. 144, 1782, East Indies.
Le Tetrodon plumier Lacépède, Hist. Nat. Poiss., I, 504, 1797, Martinique; on a drawing by Plumier.
Le Sphèroide tuberculé Lacépède, Hist. Nat. Poiss., II, 1, 1798, Martinique; on a front-view drawing by Plumier.
Tetrodon plumieri Bloch & Schneider, Syst. Ichth., 508, 1801, Martinique; after Lacépède.
Sphæroides tuberculatus Pillot edition of Lacépède, VI, 279, 1831, Martinique.
Tetrodon turgidus Poey, Synopsis, 432, 1868, Cuba; not of Mitchill.
Spheroides spengleri Jordan & Evermann, 1732, 1898; in part only; description confused with that of *S. nephelus*.

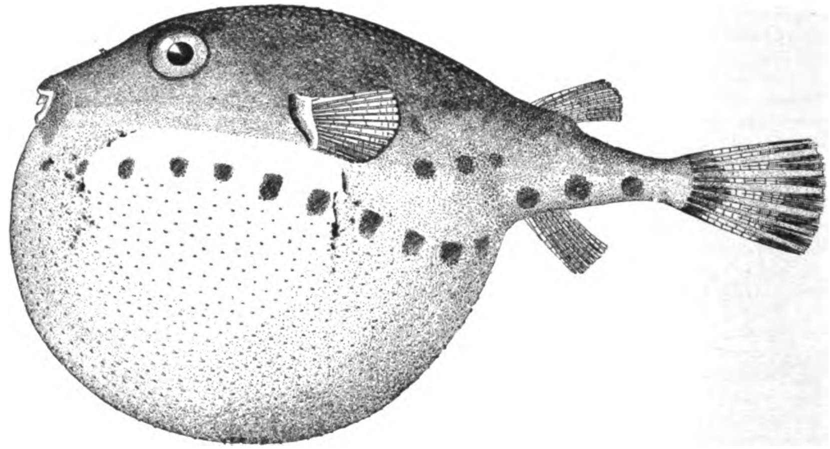

FIG. 79.—*Spheroides spengleri.*

225. **Spheroides marmoratus** (Ranzani). *Spiny-back Blow-fish.*

Head 2.75; depth 4; eye 4.5 in head; snout long, 1.66 in head; D. 7; A. 6; P. 14. Outline of head concave in front of eye; eye full and high, its distance above a line drawn from corner of mouth to upper base of pectoral equal to its longitudinal diameter. Interorbital space very narrow, grooved, its width equal to that of pupil. Nostrils at end of a tube, situated about equally distant from end of snout and posterior edge of eye. Gill-opening equal to base of pectoral, but higher. Length of caudal peduncle from anal 2 in head. Length of head equal to half of distance in front of dorsal. Posterior rays of dorsal 1.5 in longest, which are 2.5 in head. Pectoral very broad, folding fan-like, margins scalloped, broadly rounded, lowest ray 1.8 in upper, which is 2.75 in head. Caudal fin slightly longer than distance of its base from dorsal, its rays all of equal length, 1.57 in head. Prickles on ventral surface between chin and vent, extending on side of head in front of pectoral fin, on side behind pectoral fin to vertical from dorsal, above from nostrils to dorsal; only snout, axil of pectoral, and caudal peduncle naked. Lateral line very faint, extending obliquely upward from side of snout under eye, then backward, curving slightly downward under dorsal, most distinct on side of tail.

Color in alcohol: Above very dark-brown, with black blotches, sides lighter, with very pale reticulations, a series of about a dozen irregular black spots along lower side; below white; caudal slightly dusky, with no indications of bars; other fins colorless.

This species differs from *Spheroides spengleri* in the high and prominent eye, very narrow interorbital, strongly concave outline of snout, extensive distribution of prickles, and in color. It is found in the West Indies to Brazil; recorded from Brazil and Jamaica; common in Porto Rico, the collection containing specimens from San Antonio Bridge, Aguadilla, Mayaguez, and Hucares.

Tetrodon marmoratus Ranzani, Nov. Comm. Ac. Sci. Inst., Bonon., IV, 1840, 72, pl. 10, fig. 1, Brazil.
Spheroides marmoratus, Jordan & Evermann, l. c., 1733, 1898.

226. Spheroides testudineus (Linnæus). "*Tamboril*"; *Tambor; Globe-fish; Puffer.*

(PLATE 41.)

Head 3; snout moderately long, 2 in head; eye small, about 7.5 in head, nearer gill-opening than end of snout; interorbital width 4 in head; D. 8; A. 6; skin of back from nape to before dorsal fin covered with small, sparsely set prickles; belly from throat to anal with prickles which are rather large and closely set; axil usually prickly, these prickles rarely wanting or obscured; sides sometimes with cirri. Back dark-olivaceous, with whitish curved lines and streaks paler than the ground-color, these streaks usually arranged as follows: A circle or rhomb on middle of back, in front of dorsal fin, this surrounded by an ellipse, the ellipse sometimes broken up by cross-streaks; before this 3 or 4 cross-streaks extending downward and backward, one at nape and one behind eyes connected on median line; back and sides with many irregular, round, blackish spots of different sizes; a dark bar at base of pectoral; caudal dusky at base, then pale, posterior half blackish; skull not very broad, interorbital area somewhat concave, prefrontal grooves narrow. Length a foot or more.

An inhabitant of the West Indies, generally common; occasionally ascending rivers; ranging north in the Gulf Stream to Woods Hole; recorded from several points in Florida and apparently common in Porto Rico, the collections containing specimens from Palo Seco, Aguadilla, Mayaguez, Ensenada del Boqueron, Fajardo, Hucares, San Antonio Bridge, and Isabel Segunda; taken by Mr. Gray at San Geronimo; recorded also from Jamaica, Dominica, Puerto Cabello, and Brazil.

Ostracion oblongus glaber, Artedi, Genera Piscium, 60; after Clusius, Willughby, etc.. Balk, Amoen. Acad. I, 591, 1749.
Orbis lævis variegatus (the Globe-fish), Catesby, Nat. Hist. Carolina, pl. 28, 1743, Virginia.
Tetraodon testudineus Linnæus, Syst. Nat., ed. X, 332, 1758; based on Balk and Artedi.
? *Tetrodon punctatus* Bloch & Schneider, Syst. Ichth., 506, 1801, Brazil.
Tetrodon geometricus Bloch & Schneider, Syst. Ichth., 508, 1801, Virginia; after Catesby.
Tetrodon ammocryptus Gosse, Nat. Sojourn Jamaica, 287, 1851, Jamaica.
Anchisomus reticularis (Kaup) Richardson, Voyage Herald, 161, pl. 31, 1854; not *Tetrodon reticularis* Bloch & Schneider, which is *Tetrodon testudineus* Bloch, not of Linnæus.
Holacanthus leionothos Gronow, Syst. Nat., ed. Gray, 24, 1854, American ocean.
Tetrodon testudineus, Poey, Fauna Puerto-Riqueña, 347, 1881; Stahl, l. c., 81 and 167, 1883.
Spheroides testudineus, Jordan & Evermann, l. c., 1734, 1898.

Family LX. CANTHIGASTERIDÆ. The Sharp-nosed Puffers.

This family includes small puffers, similar in external appearance to the *Tetraodontidæ*, but with the snout sharp and the back more or less compressed or ridge-like. The skeletal characters by which the group is defined are thus given by Dr. Gill: Medifrontals separated from supraoccipital by intervention of sphenotics, which are connected and laterally expanded, but short; prosethmoid prominent above, enlarged and narrowed forward. Vertebræ about 8 + 10. Head compressed, with a projecting, attenuated snout; dorsal and anal short, few-rayed. Nostrils obsolete, imperforate.

One genus, with 15 species, found in the tropical seas; none over 5 inches in length.

Genus 125. CANTHIGASTER Swainson.

Characters of the genus included above.

227. Canthigaster rostratus (Bloch). *Sharp-nosed Puffer.*

Head 2.6; eye 3.6; snout 1.7; interorbital 3; D. 6; A. 8; caudal of 9 rays, 1.6 in head. A tetraodont with a produced and pointed snout, elevated and somewhat compressed back, and the belly and back with weak prickles.

Color in life: Back and one-third distance down side olivaceous, rest of body pale, demarcation rather abrupt, an oblong black blotch extending downward and forward from front of dorsal; about 12 narrow blue lines radiating from eye; snout with 6 or 8 similar lines; side of head with many small blue spots, fainter ones scattered over body; a group of finger-like bars upward from base of anal, and another behind the first on caudal peduncle; fins pale, except the caudal, which has some orange on middle rays, upper and lower rays brown, their bases each with a black blotch. In spirits, much the same, the blue becoming brown.

A small and prettily colored puffer, not uncommon; found in the West Indies, north, in rather deep water, to the banks off Pensacola; also in the Madeiras and Bermudas. Seven examples, 1.75 to 2.75 inches long, taken in the seine at San Antonio Bridge and Fajardo, and 2 from San Geronimo.

Tetrodon rostratus Bloch, Ichthyol., I, pl. 146, 1782, India.
Tetrodon capistratus Lowe, Proc. Zool. Soc. London 1839, 90, Madeira.
Tetrodon ornatus Poey, Synopsis, 433, 1868, Havana.
Canthigaster rostratus, Jordan & Evermann, l. c., 1741, 1898.

Family LXI. DIODONTIDÆ. The Porcupine-fishes.

Body short, broad, depressed above. Belly moderately inflatable, covered everywhere except on lips and caudal peduncle with spines, which are usually 2-rooted or 3-rooted at their bony base. Caudal peduncle short and slender. Mouth moderate, terminal, each jaw covered with a bony plate like the beak of a bird, these not divided by a median suture. Nostrils on each side forming a small tentacle, usually with two openings. Eye rather large, gill-opening moderate, immediately in front of pectoral, which is short, broad, and rounded. Dorsal and anal fins short, similar to each other, rounded in form and placed posteriorly.

The *Diodontidæ* comprise about 6 genera and 15 species, sluggish fishes, living on the bottom among weeds and corals, in tropical seas. When disturbed, they swallow air and float belly upward on the water. Their capacity of inflation is very much less than that of the *Tetraodontidæ*, from which family they differ chiefly in the stronger armature and in having no division in the bony plate of either jaw. Rarely used as food, being generally regarded as poisonous. The species are mostly well known in collections, the singular form having attracted the attention of travelers in the earliest times.

a. Dermal ossifications very small, each one 2-rooted, with fine flexible spine or hair-like bristle. Nasal tentacles present .... TRICHODIODON
aa. Dermal ossifications mostly 2-rooted; spines rather slender, but stiff and erectile. Nasal tentacle simple, with 2 lateral openings.......... DIODON, 126
aaa. Dermal ossifications all or nearly all 3-rooted, each with a short, stiff, immovable spine. Nasal tentacle simple, with 2 openings .... CHILOMYCTERUS, 127
aaaa. Dermal ossifications of flattish, papery, or cartilaginous plates with minute hair-like papillæ; nostril short, entire, with 2 lateral openings.......... LYOSPHÆRA

Genus 126. DIODON Linnæus. Porcupine-fishes.

Body robust, belly moderately inflatable. Dermal spines strong, stiff, most of them 2-rooted and erectile, a few 3-rooted and therefore immovable; both jaws entire; nasal tube simple, with two lateral openings. Pectorals broad, their margin undulate, upper lobe longest; vertical fins rounded, dorsal and anal short, posteriorly inserted, similar to each other.

Found in tropical seas, the few species being very widely distributed.

a. Spines terete.
  b. Frontal spines not as long as post-pectoral spines (in adults not half as long, about as long as eye); predorsal spines very short, 3-rooted, fixed or nearly so; 20 spines in a series between snout and dorsal; post-pectoral spines very much elongate, especially in adult, shorter in young; dorsal rays 15; anal 15; upper lobe of pectoral little longer than lower. Adult above everywhere covered with round black spots, these largest in front of dorsal, smallest on naked area about mouth; white below; fins profusely spotted with black; young with fewer spots, but never with large blotches.......... *hystrix*, 228
  bb. Frontal spines long, usually longer than post-pectoral spines, about twice as long as eye in adult; predorsal spines not shortened, 2-rooted, erectile; 14 to 17 spines in a series between snout and dorsal; post-pectoral spines not especially elongate, their development variable; dorsal rays usually 12; anal 12; pectoral broader than long, its upper lobe pointed, lower lobe rounded. Body marked with black spots and blotches, irregular in size, usually a broad black bar from eye to eye, continued below eye as a narrow bar; a broad bar across occiput; a black blotch above each pectoral; a short bar in front of dorsal; another in which dorsal is inserted; a blotch behind pectoral, and many small spots and blotches on upper parts; fins with few spots, usually unmarked in the young .... *holacanthus*, 229
aa. "Spines compressed laterally, short; 15 spines in a series between snout and dorsal; upper parts covered with round spots, those about pectoral sometimes confluent into a blotch; fins immaculate".......... *maculife-*

228. Diodon hystrix Linnæus. *Porcupine-fish; Erizo; Puerco Espino; "Guanabano."*

Head 3; depth 3.5; D. 13 to 15; A. 13 to 15. Spines strong, dilated at base, with a pair of basal grooves; frontal spines not as long as post-pectoral spines (in adults not half as long, about as long as eye); post-pectoral spines longer than any others, especially in adult, usually about as long as pectoral fin, those of posterior part of back and tail short and broad, 3-rooted, and therefore not erectile; predorsal spines very short, 3-rooted, fixed, or nearly so; about 20 spines in a series between snout and dorsal; upper lobe of pectoral little longer than lower; upper and lower part of tail with 2 or 3 pairs of 3-rooted, immovable, recumbent spines. Adult above everywhere covered with small, round, black spots, these largest in front of dorsal, smallest on naked area about mouth; white below; fins all more or less spotted in adult, nearly plain in young.

This species attains a length of about 3 feet. An inhabitant of the tropical seas, everywhere common, north to Lower California, Florida, and Hawaiian Islands; abundant in collections, being stuffed and dried as a curiosity; not used as food; recorded from the Tortugas, Key West, Biscayne Bay, and Indian River in Florida, and by Jordan & Rutter from Jamaica; not seen by us in Porto Rico, but recorded from there by Professor Poey and Dr. Stahl.

Orbis echinatus Rondelet, De Piscibus, 324, 1558, Northern Ocean.
Guamajacu guara Marcgrave, Hist. Nat. Bras., 159, 1648, Brazil.
Ostracion conico oblongus, Artedi, Genera Piscium, 60, No. 19, 1738.
Erizo, Parra, Desc. Dif. Piezas, Hist. Nat. Cuba, 60, pl. 29, fig. 1, 1787, Havana.
Diodon hystrix Linnæus, Syst. Nat., ed. X, 335, 1758, India; after Artedi.
Diodon atinga Bloch, Ichth., IV, 75, pl. 125, 1787; not of Linnæus.
Le Diodon (Plumier) Lacépède, Hist. Nat. Poiss., II, 1 and 10, pl. 3, fig. 3, 1798, Martinique: on a drawing by Plumier.
Diodon brachiatus Bloch & Schneider, Syst. Ichth., 513, 1801, Cuba; after Parra, pl. 29, fig. 1.
Diodon punctatus, Cuvier, Mém. Mus. Hist. Nat., IV, 132, 1818, no locality.
Diodon echinus (Rafinesque) Bonaparte, Cat. Met. Pisc. Eur., 87, 1846, Mediterranean Sea: accidental.
Paradiodon hystrix, Poey, Fauna Puerto-Riqueña, l. c., 346, 1881; Stahl, l. c., 81 and 166. 1883.
Diodon hystrix Jordan & Evermann, l. c., 1745, 1898.

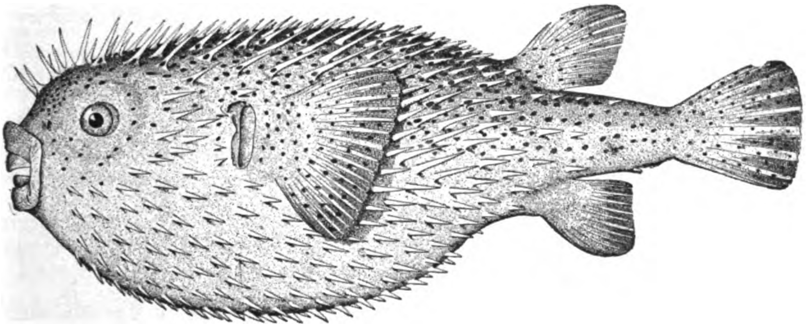

FIG. 80.—*Diodon hystrix.*

229. Diodon holacanthus Linnæus.

D. 12; A. 12. Very similar to *Diodon hystrix*, but with frontal spines usually longer than spines behind pectoral, about twice as long as eye. Predorsal spines not shortened, 2-rooted, erectile; about 14 to 17 in a series between snout and dorsal; post-pectoral spines not especially elongate, but movable; pectoral broader than long, upper lobe pointed, lower lobe rounded.

Coloration much as in *Diodon hystrix*, but more variable, spots fewer and larger; usually a broad black bar from eye to eye, continued below eye as a narrow bar; a broad bar across occiput; a black blotch above each pectoral; a short bar in front of dorsal; another in which dorsal is inserted; a blotch behind pectoral, and many small spots and blotches on the upper parts; fins with few spots, mostly immaculate in young.

Found in all warm seas, north to Florida Keys, Lower California, and Hawaiian Islands, its range coinciding with that of *Diodon hystrix*, from which it may prove to be not distinct. The distinctions are generally evident in the adult, but young examples apparently intermediate are often found. Possibly the two are different sexes of the same species. Length 1 to 2 feet. The single specimen obtained by us was seined in Guanica Bay, January 28, and is 5 inches long.

Crayracion, Nos. 9 and 15, Klein, Historia Pisc., 19 and 20, pl. 3, fig. 6, 1740.
Ostracion oblongus holacanthus, Artedi, Genera, 60, No. 20.
Diodon holocanthus Linnæus, Syst. Nat., ed. X, 335, 1758, India; based on Artedi; misprint for *holacanthus*.
Le Diodon tacheté, Lacépède, Hist. Nat. Poiss., II, 13, 1798, New Cytherea.
Diodon spinosissimus Cuvier, Mém. Mus., IV, 134, 1818, no locality.
Diodon melanopsis Kaup, Wiegmann's Archiv 1855, 228.
Paradiodon quadrimaculatus, Bleeker, Atl. Ichth., Gymnod., pl. 8, fig. 2, 1865.
Diodon maculatus, var. *a*, Günther, Cat., VIII, 307, 1870; based on *Diodon tacheté* of Lacépède; St. Croix; Jamaica; Panama; South America; Hawaiian Islands; China; Sooloo Sea; Indian Ocean.
Erizo Guanabana Parra, Desc. Dif. Piezas Hist. Nat. Cuba, 62, pl. 29, fig. 2, 1787, Havana.
Diodon liturosus Shaw, Gen. Zool., V, pl. 2, 436, 1804; after *Diodon tacheté*, Lacépède.
Diodon novemmaculatus Cuvier, Mém. Mus. Hist. Nat., IV, 136, pl. 6, 1818, no locality.
Diodon sexmaculatus Cuvier, Mém. Mus. Hist. Nat., IV, 136, pl. 7, 1818, no locality.
Diodon quadrimaculatus Cuvier, Mém. Mus. Hist. Nat., IV, 137, pl. 6, 1818, Otaiti.
Diodon multimaculatus Cuvier, Mém. Mus. Hist. Nat., IV, 136, 1818, no locality.
Diodon holacanthus, Jordan & Evermann, l. c., 1746, 1898.

Genus 127. CHILOMYCTERUS Bibron. Burr-fishes.

Body broad, depressed, moderately inflatable. Dermal spines short, stout, immovable, triangular, each with 3 roots; nasal tube simple, with 2 lateral openings; tube sometimes rounded, sometimes flattened, and with partition feeble and easily torn, so that tentacle appears divided; caudal peduncle short; fins small, formed as in *Diodon;* jaws without median suture. Species numerous, of smaller size than those of *Diodon*, spines broader and lower, their bases forming a coat of mail.

CYCLICHTHYS:
a. Nasal tentacle subcylindrical, not divided.
b. Fins unspotted; supraorbital spines 2, with generally a tentacle between them: a spine in middle of forehead.
c. Superciliary edge raised.
d. Upper parts greenish-black, with a series of undulating blackish stripes running from nape backward: a similar series between eyes and across face; an ocellated black spot above pectoral; a larger one behind pectoral; an ocellated spot on each side of dorsal, and an elongated spot behind each of ventral antennæ........... *schœpfi*
dd. Upper parts plain, without series of lines; spots as in *C. schœpfi*... *spinosus*
ddd. Upper parts covered with black, hexagonal reticulations .... *antillarum*
cc. Superciliary edge not raised; upper parts with numerous black dots, some with bluish centers; a black spot in middle of nape; a large kidney-shaped spot above pectoral, and a subtriangular blotch before and along base of dorsal fin; a series of antennæ along lower part of side.................................... *antennatus*, 230
CHILOMYCTERUS:
aa. Nasal tentacle flattened, divided; fins spotted with black; supraorbital spines 3, feeble, none on forehead.
c. Supraocular cirrus well developed; upper parts densely covered with small, round, blackish spots; a large black blotch before and around dorsal, another on each side above gill-opening and pectoral; spines short, compressed, anterior root flat, longer than the others .... *atinga*

230. Chilomycterus antennatus (Cuvier). *Spiny Puffer.*

(PLATE 42.)

Spines strong, but short; 2 above orbit, 1 more or less prominent in the middle of forehead. Superciliary edge not raised; generally a tentacle between superciliary spines. Tentacles along lower part of side, 1 on each side and in advance of anal fin being especially developed. Tail spineless, but roots of one pair of spines reaching across behind dorsal fin.

A black spot in middle of nape; a large kidney-shaped spot above pectoral, and a subtriangular blotch before and along base of dorsal fin; generally a small black spot below eye; some or all of these spots edged with lighter; upper and lateral parts with numerous black dots, some with a bluish pupil; abdomen brown; fins unspotted.

In an example 3 inches long, obtained at Mayaguez, and from which plate 42 in this volume was made, the general color is a light-brown, somewhat darker on back and under parts; a large grass-green blotch on occiput, a similar oblong one above base of pectoral, and another on back across base of dorsal fin; back, head, and side with numerous small, roundish black specks; iris yellow, pupil pale-blue; fins all pale-blue or greenish-blue.

West Indies and ranging southward; recorded from St. Croix, Jamaica, Porto Rico, and Cape of Good Hope. Length 8 inches. One specimen seined at Mayaguez and one taken at San Geronimo.

Diodon antennatus Cuvier, Mém. Mus., IV, 131, pl. 7, 1818.
Chilomycterus puncticulatus Poey, Anal. Hist. Nat., 346, 1881, Porto Rico.
Chilomycterus antennatus, Jordan & Evermann, l. c., 1750, 1898.

Family LXII. SCORPÆNIDÆ. The Rock-fishes.

Body oblong, more or less compressed, head large and with one or more pairs of ridges above, which usually terminate in spines. Opercle usually with 2 spinous processes; preopercle with 4 or 5. Mouth terminal, usually large, with villiform teeth on jaws and vomer, and usually on palatines. Premaxillaries protractile; maxillary broad, without supplemental bone, not slipping under preorbital. Gill-openings wide, extending forward below; gill-membranes separate and free from isthmus, usually no slit behind fourth gill. Scales ctenoid or sometimes cycloid, usually well developed, sometimes nearly obsolete. Lateral line single, continuous, concurrent with back; a narrow bony stay extending backward from suborbital toward preopercle. Ventral fins thoracic, of normal percoid form, I, 5, rays branched; dorsal fin continuous, sometimes so deeply notched as to divide it into 2 parts, with 8 to 16 rather strong spines and about as many soft rays; anal rather short, with 3 spines and 5 to 10 soft rays; soft rays in all fins branched, except some or all of rays of pectoral; pyloric cæca in moderate or small number (fewer than 12). Pseudobranchiæ large. Air-bladder usually present. Actinosts moderate, inserted on posterior edges of hypercoracoid and hypocoracoid; ribs borne on enlarged pleurapophyses, Post-temporal bifurcate, normally connected; myodome more or less developed.

The *Scorpænidæ* are a large and very interesting family of about 30 genera and more than 250 species inhabiting all seas, but especially abundant in the temperate parts of the Pacific Ocean, where they form a large proportion of the fish fauna. They are non-migratory fishes, living about rocks. Most of them are of large size and many of the species are used as food, though some of them, particularly species in the genus *Scorpæna*, are in some places regarded as being poisonous. Whether there is any good reason for this belief has not been demonstrated. Many of the species of this family are viviparous, the young being produced after reaching considerable size.

a. Dorsal spines 12; vertebræ 10 + 14 = 24.
b. Palatine teeth present; anal rays usually III, 5.
c. Bones of head scarcely cavernous; occiput with 2 pairs of spines; scales ctenoid or provided with dermal flaps.
d. Pectoral with some of its median rays more or less branched.
e. Scales on top and sides of head ctenoid; cranium much as in *Sebastodes*, the armature moderate..... HELICOLENUS
ee. Scales on top and sides of head cycloid or wanting; cranium with many spines...................... SCORPÆNA, 128
dd. Pectoral rays all simple; head more or less scaly, the scales ctenoid.............................. PONTINUS, 129
cc. Bones of head with large muciferous cavities; occiput with only 1 pair of spines; scales cycloid; pectoral rays 20 or more; head scaleless above; no groove at occiput; some of the pectoral rays branched.............. SETARCHES

Genus 128. SCORPÆNA (Artedi) Linnæus. The Scorpion-fishes.

Body oblong, somewhat compressed. Head large, not much compressed, naked above, and more or less uneven with spinous ridges, often with dermal flaps. Mouth large, with bands of villiform teeth on jaws, vomer, and palatines. Scales mostly ctenoid, of moderate size, often with skinny flaps. Dorsal fin with 12 stout spines; anal with 3 spines, second commonly the longest; pectoral large, rounded, base usually procurrent, some or all of upper rays divided, lower simple; ventrals inserted behind pectorals. No air-bladder. Vertebræ 10 + 14 = 24. Species numerous in the tropical seas; fishes of singular forms and bright colors; the variation in squamation and armature very great, but, as in most similar cases, it is not easy to find definite characters for subdivision.

a. Breast scaly.
b. Occiput with a distinct quadrate pit.
c. Supraocular tentacle less than twice diameter of orbit.
d. Dorsal rays XII, 9.
e. Top of head scaleless, 3 small spines on suborbital carina.. *agassizii*
ee. Top of head not wholly scaleless, interorbital space incompletely scaled; suborbital carina with 6 spines. *cristulata*
dd. Dorsal rays XII, 10.
f. Anterior border of orbit with no distinct pit below it.
g. Suborbital stay with 3 distinct spines; third anal spine longer and stronger than second.
h. Axil pale, with small dark spots; body with a few large, diffuse dark spots .... *brasiliensis*, 231
hh. Axil pale without spots; body and head with numerous small milky-white spots..................... *albifimbria*, 232
gg. Suborbital stay without spines; cheek more or less scaly; second anal spine longer and stronger than third. *bergii*, 233
ff. Anterior border of eye with a distinct pit between it and suborbital stay.
i. About 30 scales on lateral line, most of scales with dermal flaps; supraorbital flap large, longer than eye; axil black, with large white spots.
j. Color rather pale or reddish; interorbital area narrow; occipital pit deep.............................. *plumieri*, 234
cc. Supraocular tentacle more than twice diameter of eye; flaps on lateral line longer than eye; suborbital stay with a small spine near its center, another at its posterior end; axil gray with many small white spots .. *grandicornis*, 235
bb. Occiput with only a very shallow depression or none.
k. Pectoral with but 2 branched rays; no pit at occiput... *inermis*.

231. **Scorpæna brasiliensis** Cuvier & Valenciennes.

Head 2.6; depth 2.66 to 3; orbit 4 in head; D. XII, 10; A. III, 5 (5.5); transverse rows of scales (oblique) about 25 to 30, (vertical) 50 to 60; tubes 25 to 30. Body short, compressed, profile convex, depth of caudal peduncle a little less than 4 in head. Head compressed; interorbital space narrow, a little more than half orbit, about 7 in head, deeply concave, deepest between preocular spines, and with 2 marked longitudinal ridges on frontal bones, parallel with supraocular ridges; a deep pit at occiput, deepest behind, its anterior side sloping back from the base of coronal (tympanic) spines, its posterior side nearly vertical; preocular, supraocular, postocular, and coronal (tympanic) spines moderate, parietal and nuchal spines sharpest, their ridges thin and sharp, exoccipital spines and ridges present; spine between orbit and occipital small, not bifid. Preorbital very broad with 2 sharp spines, no pit between anterior inferior border of orbit and suborbital stay, latter low, with 2 or 3 small spines; uppermost preopercular spine much the longest, a small spine at its base, others very small or almost obsolete; opercular spines rather small, with not very prominent ridges; all ridges of head less prominent than in *Scorpæna plumieri*. Jaws equal, lower with small symphyseal knob; maxillary reaching posterior edge of pupil, about 2.25 in head; teeth on jaws, vomer, and palatines in rather narrow bands. Pseudobranchiæ reaching down nearly to epihyal bone; gillrakers short, compressed, about 7 on anterior limb. Dorsal fin deeply notched, membrane reaching halfway up twelfth spine; dorsal spines slender, low, the longest equal to maxillary, about 2.25 in head; soft rays higher, about 1.75 in head; anal spines graduated, second a little the thickest, soft rays 1.6 in head; caudal truncate or very slightly rounded; pectoral reaching beyond origin of anal, a little shorter than head, its base not procurrent, 10 lower rays slightly thickened, exserted and simple, upper rays (except uppermost one) branched; ventrals reaching beyond vent, last soft ray attached to body for three-quarters of its length by a rather broad membrane. Supraocular flap long and slender, longer than orbit, a little more than 3 in head; preocular flap small; flaps at base of spines of preorbital and lower spines of preopercle, small ones on cheek, membrane of spinous dorsal, and on many of scales of body; larger flaps on lateral line and along base of dorsal fin. Scales large, rather smooth, with membranaceous edges; a few rudimentary scales on front and flap of opercle, on preopercle, and lower part of cheek; breast with small scales.

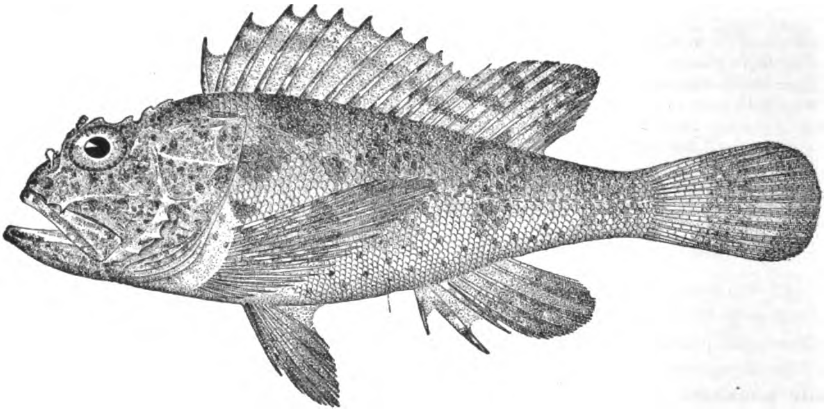

FIG. 81.—*Scorpæna brasiliensis.*

Color: Dusky-olivaceous or brownish, whitish below; a few large diffuse dark spots on side above, nearly as large as eye; posterior part of each scale darker, giving a slightly speckled appearance; axil pale, with small dark spots, which are also sparsely present along lower part of side; pectoral mottled, faintly banded, the lower part paler; spinous and soft dorsal and anal irregularly marbled; caudal with median and terminal blackish bands; ventrals dusky at tip; side of head dark with some small darker spots; snout, interorbital space, and tip of maxillary dark, faintly marbled; under side of head whitish or marbled with brownish; peritoneum white.

This species ranges from the South Atlantic and Gulf coasts of the United States to Brazil. It has been recorded from Charleston, S. C., Indian River, Biscayne Bay, Key West, Pensacola, Pensacola

Snapper Banks, Egmont Key, Boca Grande, Jamaica, and Rio Janeiro. The collections from Porto Rico contain but a single specimen, 2.75 inches long, taken in the seine at Palo Seco, January 16. It differs somewhat from larger examples in having the second anal spine stronger than third.

Scorpæna brasiliensis Cuvier & Valenciennes, Hist. Nat. Poiss., IV, 305, 1829, Brazil; Jordan & Evermann, l. c., 1842, 1898.
Scorpæna stearnsi Goode & Bean, Proc. U. S. N. M. 1882, 421, Pensacola, Fla.

232. **Scorpæna albifimbria** Evermann & Marsh, new species.

Head 2.1; depth 2.4; eye 3.3; snout 4.25; maxillary 2; mandible 1.9; interorbital 7; preorbital 6.5; scales 7–45–15, about 21 pores; D. XII, 10; A. III, 5; pectoral 19. Body very short; head heavy and broad, width 1.6 in its length; snout broad and short; profile rather evenly curved from tip of snout to origin of dorsal fin; occipital pit shallow but distinct; interorbital space rather broad, shallow; no pit below anterior part of eye; mouth large, maxillary reaching posterior border of eye; spines of head strong; supraocular ridge moderate, a strong preocular spine and two smaller supraocular ones; coronal, postocular, nuchal, parietal, and exoccipital spines strong; opercle with 2 spines, lower terminating a strong ridge; 4 preopercular spines, uppermost strong, with a small accessory spine on its base; suborbital stay prominent, with 3 evenly spaced, strong spines, in line with upper preopercular spine; nasal spines obscure; preorbital with 2 broad, blunt spines. Cephalic filaments mostly long, but slender, nasal pair short and broad; preocular pair long, greater than eye; supraocular pair slender, about equal to eye; a few small dermal flaps below suborbital stay, and a very broad one on lower edge of preorbital continuous with skin of the 2 preorbital spines. Scales small, scarcely ctenoid; scaling of head obscure; dermal flaps numerous, largest along lateral line. Fins large; longest dorsal spine 3 in head; longest ray 2.9; second anal spine 2.1, longer and somewhat stronger than third; longest anal ray 2.1; pectoral reaching origin of anal, 1.6; base broad, 2.5; third, fourth, fifth, and on one side sixth rays branched, others undivided; ventral 2.2; caudal 1.6.

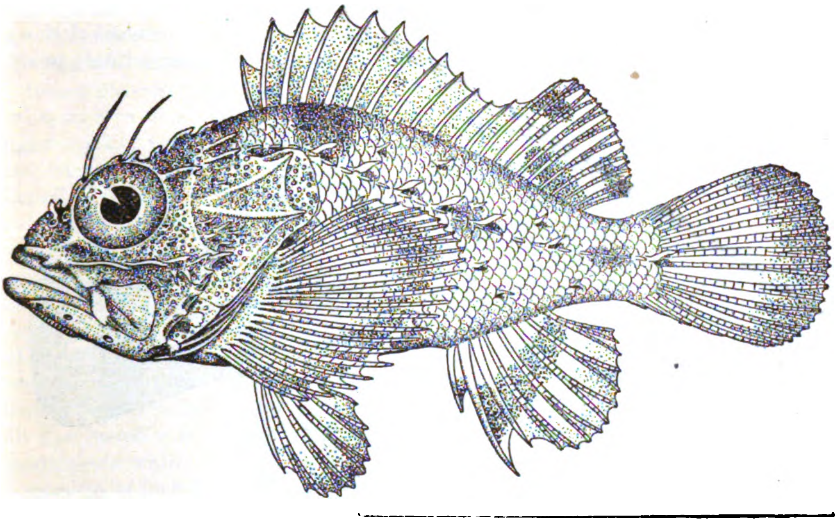

FIG. 82.—*Scorpæna albifimbria.*

Color in alcohol: Pale-rosy, with dark dustings on head, humeral region, back, and side; top and sides of head profusely covered with fine milky-white specks; similar spots on body, but less numerous; dermal flaps on head and body all milky-white; under part of head white, a large rosy blotch at base of fourth to seventh dorsal spines; dorsal rosy, richest on soft portion; anal pale, with some black on membrane between first and second spines; caudal pale; pectoral rosy, with dark dustings around margin; axil pale, without spots; ventrals pale, dusky at tips. In life the rosy color was doubtless much more evident.

This species seems quite distinct from any previously known species of *Scorpæna*. Its most characteristic features are the numerous milky-white specks and dermal flaps. The only specimen obtained is the type (No. 49532, U.S.N.M.), 1.75 inches long, taken in the tangle February 8 at Fish Hawk station 6093, off Culebra Island, 5.25 miles southwest of Culebritas Light-house, in 15 fathoms, on live coral bottom.

Albus, white; *fimbria*, flap.

233. **Scorpæna bergii** Evermann & Marsh, new species.

Head 2.4; depth 2.7; eye 3.5; snout 4.8; maxillary 2.4; mandible 2; interorbital 6; preorbital 6.5; D. XI, 10; A. III, 5; pectoral 17; scales 9–38–15, about 22 pores. Body short and stout; head short and broad, width 1.4 in its length; snout short and broad; cephalic spines and ridges prominent; supraocular ridges strong, with 3 spines; interorbital groove deep, its 2 ridges very low; a pair of strong nasal spines; occipital pit deep, a deep transverse postocular groove crossing occipital pit; a small spine at each anterior angle of pit and a larger one at each posterior angle, back of which is, on each side, a smaller spine; a postocular and 2 small humeral spines; opercle with 2 strong flat spines and 2 short blunt ones below; preopercle with 5 blunt spines, upper one largest and with a small accessory spine on its base; no pit below anterior part of eye; suborbital stay strong, without any spines except terminal one at posterior end; preorbital with 3 blunt spines, 2 of them obscure; maxillary broad, reaching past pupil; cephalic filaments short; a pair of short nasal cirri, a small pair on anterior part of supraocular ridge and a larger pair on posterior part of same ridge; preorbital with 2 flat flaps, anterior the smaller; dermal flaps on body few and small, a series of 7 or 8 along lateral line; fins high; distance from snout to origin of dorsal 3 in body; first dorsal spine 1.5 in second, which equals eye; fourth spine longest, 2.6 in head; longest dorsal ray 2.75 in head; first anal spine 1.75 in second, which is 2.2 in head; third anal spine weaker and somewhat shorter than second; longest anal rays 2.5 in head, pectoral broad, its base 3 in head, length 1.6; tips of rays nearly reaching anal; ventral 2 in head, reaching past vent; caudal 1.8 in head.

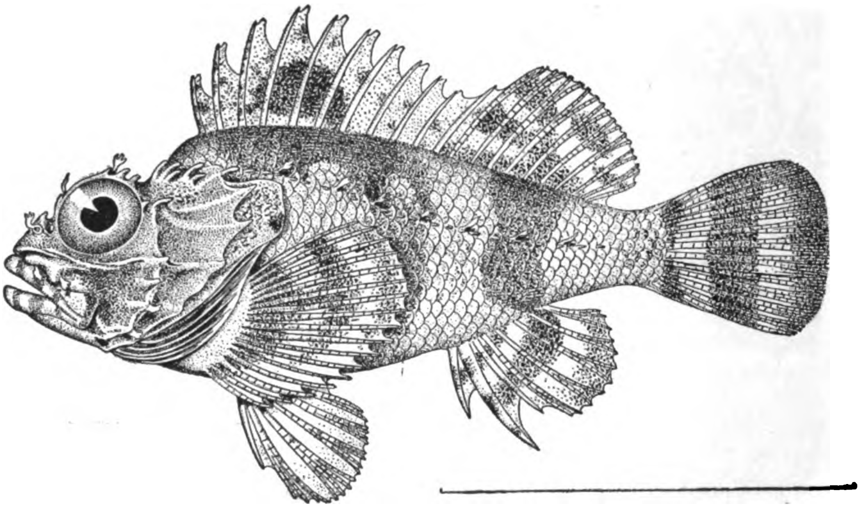

FIG. 83—*Scorpæna bergii.*

Color in alcohol: Dark-grayish on head and body, under parts paler; a broad black bar crossing body between soft dorsal and anal and extending across these fins; caudal peduncle pale, with a narrow black bar at base of fin; dorsal grayish mottled with black and white, a large round black spot between third and seventh spines; soft dorsal with 2 or 3 broad black bars with pale interspaces; anal pale at base, with a few dark spots, then a pale band, next a broad black band continuous with that on body, then a broad white band, followed by another blackish bar, tip of fin white-edged; pectoral gray, crossed by 3 blackish bands; axil pale, with 5 or 6 large round brown spots; ventral pale.

This species seems related to *S. pannosa* Cramer, from Panama, but differs in many important respects, notably in the fewer pectoral rays, the greater length of the pectoral, and the color. The presence of but 11 dorsal spines instead of 12, the usual number, may be merely an individual variation and of no specific value. It is known only from the type (No. 49533, U. S. N. M.), 3 inches long, obtained at Mayaguez, January 20, and one cotype (No. 813, U. S. F. C.), 2 inches long, seined at Culebra Island, February 11.

Named for Dr. Carlos Berg, director of the National Museum of Buenos Ayres, in recognition of his excellent work on South American fishes.

234. **Scorpæna plumieri** Bloch. *Rascacio.*

Head 2.25 to 2.5; depth 3; eye 5; snout 3.75; maxillary 2; mandible 2; interorbital 4.75; preorbital 5.5; D. XII, 10; A. III, 5; scales 8–40–16, about 25 pores. Body short and thick; head irregular in form, with many grooves and pits, and numerous fleshy flaps; a large, deep quadrate pit on occiput; a large, deep pit below anterior part of eye, between it and front of suborbital stay; supraocular ridge with 2 long flaps, posterior one broadest, each nearly twice length of eye; anterior nostril with a double fringed flap, about two-thirds length of eye; a pair of simple, slender tentacles on snout, each somewhat longer than eye; 3 or 4 flaps on edge of preorbital; numerous other smaller, shorter flaps along edges of opercle and elsewhere about head; parietal, nuchal and exoccipital spines present; suborbital stay with 3 or 4 sharp spines; preopercular and opercular spines moderate, bluntish, a smaller spine at base of upper preopercular spine; occiput with 2 pairs of spines; a few scales on preopercle and opercular flap, head otherwise scaleless; maxillary long and broad, reaching to posterior border of eye; lower jaw included; breast covered with small embedded scales; scales of body large, thin, firm, many of them with membranaceous flaps; lateral line with a series of fleshy flaps; dorsal low, longest spine 2.6 in head, longest ray 2.6; first anal spine short, second much stronger and somewhat longer than third, 2.5 in head; longest anal ray 2.2; pectoral broad, procurrent, reaching about to anus, 1.4 in head, upper rays branched, lower simple, tips free; ventrals reaching anus, 1.9 in head, equal to caudal.

Color, highly variegated and subject to much variation; sand-color, with 2 broad, blackish shades on body and 1 on head; belly purplish; lower parts of head finely speckled in all shades of light, dark, and pearly bluish; upper parts covered with whitish cirri profusely speckled; surface appearing as if covered with sand; eye with radiating dark spots; dorsal covered like body with some well-marked whitish spots; dark band of body passing on to soft dorsal; caudal variously mottled, with 3 pale and 3 black bands; anal whitish, variegated with reddish and black; ventrals similar, with more maroon-red; pectoral still more variegated, tip scarlet-shaded; inside of pectoral largely bright-yellow, then blackish, tinged with cherry-red; axil jet-black, with large, round, white spots, not fading in alcohol; lips barred with black and whitish; branchiostegal membranes and angle of mouth bright-yellow; peritoneum white.

The rascacio is found from southern Florida to Brazil; it is common among the Florida Keys and has been recorded from Clearwater Harbor, the Tortugas, and Key West. It was obtained by the Nutting expedition off Key West in 60 fathoms. It is known also from Jamaica, Cuba, and Martinique, and Porto Rican specimens were obtained by us at San Antonio Bridge, Mayaguez, Puerto Real, Guanica, Ponce, and Hucares. It is, next to *S. grandicornis*, the most abundant species of the family in Porto Rican waters. It reaches a length of a foot or more.

The above description is based upon a specimen 10 inches long, from San Antonio Bridge.

Scorpæna plumieri Bloch, Nya. Handl. Stockh., X, 234, 1789, Martinique.
Scorpæna bufo Cuvier & Valenciennes, Hist. Nat. Poiss., IV, 306, 1829, Martinique; Poey, Fauna Puerto-Riqueña, 323, 1881.
Scorpæna rascacio Poey, Synopsis, 303, 1868, Havana.
Scorpæna plumieri, Jordan & Evermann, l. c., 1848, 1898.

235. **Scorpæna grandicornis** Cuvier & Valenciennes. *Rascacio; Lion-fish.*

Head 2.5; depth 2.6; eye 4; snout 4; maxillary 2.2; mandible 1.75; interorbital 5; preorbital 6.75; D. XII, 10; A. III, 5; P. 17; scales 9–40–15, about 28 pores. Body short, more compressed than in *S. plumieri;* head rough with many spines and ridges; a deep quadrate pit on occiput; a shallow suborbital groove but no pit at its anterior end; interorbital groove deep but narrow; suborbital stay not strong, with 1 small spine near its middle and 1 at its posterior end; supraocular ridge with 1 strong spine on posterior portion; 2 spines on side of nape at posterior angle of pit, the anterior with a fringed filament; below these, 3 other spines in an irregular row; opercle with 2 flat spines; preopercle with 3 flat spines, the one at angle strongest, and with a supplementary spine on its base; a pair of short nasal spines; supraocular filament long, broad, and fringed, more than twice length of eye; a short filament on front of supraocular ridge and a small one on upper part of eye; anterior nostril with a short fringe; a pair of short filaments at tip of snout; 2 or 3 short, broad, dark flaps on cheek and others on various parts of head; dorsal high, longest spine 2 in head, equaling longest ray; first anal spine short, less than half second, which is slightly longer, but much stronger, than third, 1.9 in head, or equaling longest anal ray; pectoral broad, width at base 2.5 in head, length 1.2, upper rays but one divided, lower simple, their tips free, longest ray reaching past origin of anal; ventrals shorter, barely reaching origin of anal, 1.6 in head; caudal 1.5 in head. Scales smooth, thin, and firm; a series of very large dermal flaps along lateral line and smaller flaps scattered over body; a few embedded scales on cheek and opercle; breast scaled.

Color in life variable. Three examples, taken at San Antonio Bridge January 14, were described as follows: Body dark-brown, inclining to brick-red; belly pale-reddish; top and sides of head olive-brown; dorsal brown, soft portion palest; caudal reddish-brown, crossed by 2 narrow pinkish bars; anal brownish, a large black blotch near base of rays, then a broad whitish bar with reddish blotches, next a series of 5 black spots on rays, then brown, and last a pale border; pectoral brown with a narrow pale border and 2 irregular dark crossbars separating lighter-brown, central portion of fin with light wash of old gold; axil pale-grayish with numerous small white spots; similar but larger spots upon branchiostegals; lower jaw greenish, with series of white blotches; ventrals pale at base, then 3 oblong black blotches on middle rays, beyond which is pale-brown with pale border. Two other examples taken at same time had body brownish, belly rosy; head mottled-brownish; dorsal brown, soft part paler; caudal pale with 2 broad brown bars; ventrals rosy at base, dark at tips; pectoral yellowish-brown, with black on tips of upper rays and a black blotch at base of lower rays; ocular cirri brown.

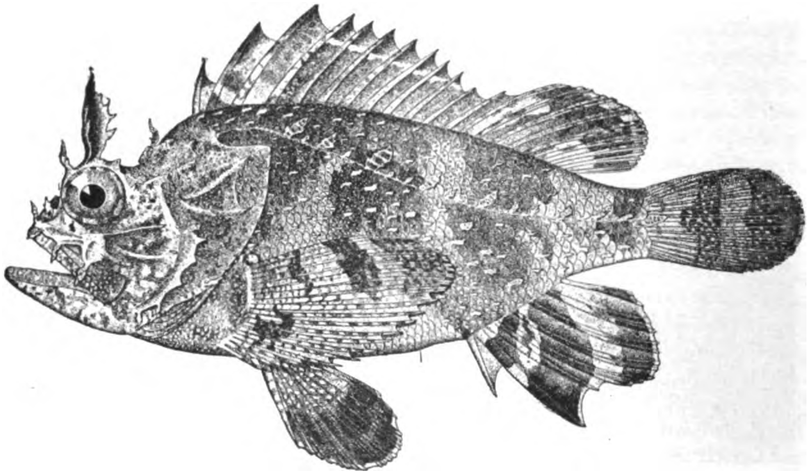

FIG. 84.—*Scorpæna grandicornis.*

The lion-fish occurs from the Florida Keys to Brazil, and has been recorded from Key West, Havana, Santo Domingo, Porto Rico, Jamaica, and Martinique. It is the most abundant species of the family about Porto Rico, our collections containing numerous specimens from San Juan, San Geronimo, Aguadilla, Mayaguez, Puerto Real, Ensenada del Boqueron, Guanica, Ponce, Hucares, and Fajardo. While *Scorpæna plumieri* is often found in water of considerable depth, this species frequents shallow water among algæ, where, on account of its remarkable protective coloration and long alga-like filaments, which are also in the nature of protective mimicry, together with the rough armature of the head and its poison spines, it would seem extraordinarily well protected. It reaches the length of a foot or less and is of striking appearance, much dreaded by the fishermen, who pronounce it "muy malo" and can not be induced to touch it.

Scorpæna grandicornis Cuvier & Valenciennes, Hist. Nat. Poiss., IV, 309, 1829, Martinique, Porto Rico, Havana, Santo Domingo; Poey, Fauna Puerto-Riqueña, 323, 1881; Stahl, l. c., 78 and 164, 1883; Jordan & Evermann, l. c., 1850, 1898.

Genus 129. PONTINUS Poey.

This genus differs from *Scorpæna* chiefly in having the pectoral rays all simple and only their tips free; anal with 5 to 9 rays; suborbital keel composed of 3 or 4 distinct, differentiated spines, 2 prominent retrorse spines on each preorbital; no pit at occiput; scales ctenoid; cheek and opercles usually scaly; pectoral not procurrent. The American species all have D. XII, 10; A. III, 5. Of the seven known American species only two were obtained in Porto Rico.

a. Base of pectoral broad, fin fan-shaped.
  b. Snout naked above, as is interorbital space.
    c. Eleventh dorsal spine nearly as long as twelfth.
      d. Eye small, 4.1 in head .... *beanorum*, 236
      dd. Eye larger, 3.4 in head .... *macrolepis*, 237
    cc. Eleventh dorsal spine half as long as twelfth.
      e. Eye 5.5 in head; maxillary reaching two-thirds across eye; head 4 in total length; spinous dorsal low; pectoral pointed; supraorbital tentacle 5 in total length; carmine, without marblings .... *castor*
      ee. Eye 4 in head; maxillary reaching anterior third of orbit; spinous dorsal high; pectoral rounded; carmine with vertical rosy bands .... *pollux*
  bb. Snout fully scaled above; interorbital space with few scales, top of head otherwise entirely scaly .... *rathbuni*
aa. Base of pectoral narrow.
  f. Head without filaments; nape and top of snout scaly; ventrals reaching vent. Pectoral rays 16 .... *longispinis*

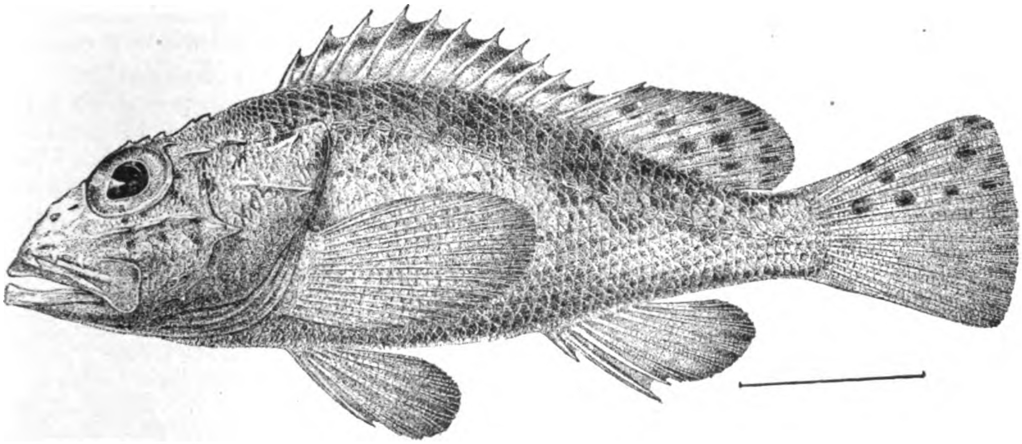

FIG. 85.—*Pontinus beanorum.*

236. Pontinus beanorum Evermann & Marsh, new species.

Head 2.5; depth 3.5; eye 4; snout 4; maxillary 2.4; mandible 2.25; interorbital 9; preorbital 6.2; D. XII, 10; A. III, 5; P. 16; scales 7-36-11, about 24 pores. Body short and stout, head heavy, its width 1.6 in its length; snout moderately long, broad; profile regularly curved from tip of snout to origin of dorsal; occiput scarcely depressed; spines of head much as in *P. macrolepis*, but smaller; a pair of small nasal spines; supraocular ridge with 3 spines, first at anterior end scarcely perceptible, the 2 others near posterior end, each short and weak; postocular, tympanic, parietal, and nuchal spines present but short; 1 paroccipital and 2 humeral spines present, all small; 2 stouter, flat spines on opercle, lower at end of a low ridge; 4 preopercular spines, upper largest and with a small accessory spine on its base; suborbital stay strong, with 4 spines, first small and indistinct, near anterior end, second under anterior edge of pupil somewhat stronger, third under posterior edge of eye and last at end of stay, third and fourth about equally strong; preorbital with 3 broad, blunt spines; no occipital pit; no pit below eye; interorbital narrow, a central groove, between which and each supraocular ridge there is a small sharp ridge; premaxillary broad, reaching middle of eye; nape, opercle, and cheek scaled, rest of head naked; scales of body moderate in size, firm, ctenoid; breast scaly; head almost without cirri, the only ones being a pair of small internasal filaments, a pair of small supraocular ones, and a cluster on edge of suborbital; no dermal flaps on scales; teeth in villiform bands on jaws, vomer, and palatines; anterior nostril tubular, with a rather broad fringed flap; distance between anterior nostril and eye greater than interorbital width; distance from tip of snout to origin of dorsal twice length of maxillary; first dorsal spine 1.6 in second; fourth dorsal spine about 3.5 in head, penultimate spine 5 in head, last about 4, or about twice length of first spine; longest dorsal ray 2 in head; first anal spine very short, about 7.5 in head, second about 3 times length of first, 2.6 in head; third somewhat shorter and much weaker than second; pectoral base not so broad as in *P. macrolepis*, 3.75 in head, rays all simple, reaching origin of anal, 1.6 in head; ventrals shorter, their tips scarcely reaching vent, 1.6 in head; caudal 1.7.

Color in life: Back and top and sides of head pale-rosy, with irregular brownish markings; lower parts of head richer rosy; belly white, with some rosy; dorsal pale-rosy, with a series of large irregular brownish spots along outer border; soft dorsal with brownish spot; caudal pale-rosy, upper half with brown spots, lower half plain; anal rosy, dark at tip; pectoral and ventral rosy, blackish on outer portion.

This species resembles *P. macrolepis*, from which it differs in the much smaller eye, longer snout, fewer and smaller cephalic cirri, somewhat smoother head, narrower pectoral, and the very different coloration. The only example obtained is the type (No. 49534, U. S. N. M.), 5.5 inches long, taken in the beam trawl January 13, 1899, at Fish Hawk Station 6050, 1.25 miles northward from the entrance to San Juan Harbor, in 91 fathoms.

This interesting species is named in honor of Dr. Tarleton H. Bean, director of forestry and fisheries of the United States Commission at the Paris Exposition of 1900, and his brother, Mr. Barton A. Bean, acting curator of fishes in the U. S. National Museum, in recognition of their valuable services to American ichthyology.

237. **Pontinus macrolepis** Goode & Bean.

(PLATE 43.)

Head 2.2; depth 3.25; eye 3.4; snout 4.5; maxillary 2.4; mandible 2.2; interorbital 10; preorbital 9; scales 6–35–10, about 22 pores; D. XII, 10; A. III, 5; P. 17. Body short; head large, its width half its length; snout short and broad; profile not much arched; occiput not depressed; interorbital groove deep, a slight ridge on each side at base of supraocular ridge; no pit under anterior part of eye; spines of head strong; a pair of moderate nasal spines, 1 at anterior end of supraocular ridge and 2 stronger ones near its posterior end; postocular, tympanic, nuchal, and parietal spines strong; 1 paroccipital and 2 humeral spines present; 2 flat, stout, opercular spines, and 4 on preopercle, upper one strongest and with an accessory spine on its base; suborbital stay prominent, with 3 strong spines; 2 strong spines on preorbital, each directed backward; scales strongly ctenoid, rubbing off easily; nape, opercles, and cheek scaled, rest of head naked; breast with small embedded scales; cephalic tentacles moderate, a short, broad nasal pair; a slender one at preocular spine, and a longer one, about 2 in eye, at supraocular spine; another small pair on nape and 2 small filaments on preorbital; distance from tip of snout to origin of dorsal twice length of maxillary; first dorsal spine about three-fifths of second, third longest, 2.4 in head; longest dorsal rays 2.5 in head; eleventh spine about 4.5 in head; twelfth 3.75; longest dorsal ray 2.5; first anal spine about 3 in second, which is 2.6 in head and longer and stronger than third; longest anal ray about 2.4; pectoral rays all simple, scarcely reaching anal, 1.5 in head; ventral shorter, 2 in head; caudal 2.1.

Color in life: Pale below, reddish above; body with about 6 vertical bars of deeper red reaching to lateral line or below; head chiefly red, iris gray, upper and lower edges red, pupil black; dorsal with 2 long rows of light-red blotches; pectoral with 3 V-shaped, vertical, light-red bars; bases of ventral and pectoral reddish; caudal with 3 curved, vertical, yellowish bars; a series of oblong reddish spots on caudal membrane at margin.

Hitherto known only from the type, a specimen 4.4 inches long, from off Yucatan. Our collection contains a single specimen 5.5 inches long, dredged by the *Fish Hawk* at station 6068, in 224 to 237 fathoms, in Mayaguez Harbor, 7.5 miles northwest from the Mayaguez custom-house.

Pontinus macrolepis Goode & Bean, Oceanic Ichthyology, 257, fig. 247, 1896, lat. 20° 59′ 30″ N., long. 86° 23′ 45″ W., at Albatross station 2354, off Yucatan, in 130 fathoms; Jordan & Evermann, l. c., 1856, 1898.

Family LXIII. TRIGLIDÆ. The Gurnards.

Body elongate, usually more or less fusiform, covered with scales or bony plates. Head externally bony, entirely cuirassed with rough, bony plates, some of which are armed with spines; eyes high; mouth terminal or subinferior; premaxillaries protractile; maxillary without supplemental bone, slipping under preorbital; teeth very small, in bands in jaws, and usually on vomer and palatines; gills 4, a large slit behind fourth; pseudobranchiæ present; gillrakers various; gill-membranes free from isthmus. Ventral fins thoracic, wide apart, separated by a flat area, their rays I, 5. Spinous dorsal present, short; soft dorsal similar to anal, which is without spines; caudal narrow, few-rayed; pectoral large, with broad base, with 3 lower rays detached, forming feelers. These free rays are used chiefly in search for food, turning over stones, exploring shells, etc. Air-bladder present; pyloric cæca usually present, few in number.

Singular-looking fishes, found in all warm seas, comprising 5 genera and about 40 species, some of them in rather deep water, these red in color, the others living about rocks.

a. Palatines with teeth.
b. Dorsal spines low, the longest usually much shorter than head; scales moderate, 50 to 80 pores .... PRIONOTUS, 130
bb. One or 2 of the dorsal spines greatly elevated, about as long as body; scales large, rough, the pores 40 .. BELLATOR
aa. Palatines toothless; scales small.
c. Lateral line without enlarged bony plates .... CHELIDONICHTHYS
cc. Lateral line armed with a series of transverse bony plates .... TRIGLA

Genus 130. PRIONOTUS Lacépède.

Body subfusiform; profile of head descending to the broad depressed snout, which is much longer than the small eye; eyes close together, high up; surface of head entirely bony, bones rough with ridges and granulations; scales on head few or none; preopercle with 1 or 2 sharp spines at its angle; opercle with a sharp spine; nape with two strong spines; a spine on shoulder-girdle. Mouth rather broad; bands of small, almost granular, teeth on jaws, vomer, and palatines; gill-membranes nearly separate, free from isthmus; gillrakers rather long. Body covered with small, rough scales, which are not keeled; lateral line continuous; scales on breast very small. Dorsal fins distinct, first of 8 to 10 rather stout spines, third usually highest, but mostly shorter than head; anal fin similar to soft dorsal; pectoral fin with 3 lower anterior rays thickened, entirely free from each other and from fins; ventrals I, 5, wide apart, with a flat space between them, inner rays longest. Pyloric cæca in moderate number; air-bladder generally with lateral muscles and divided into 2 lateral parts; vertebræ 10 or 11+15.

Species numerous, all but one being American, representing in America the Old World genus *Trigla*, some in deep water. They are well defined and easily recognized, but vary considerably with age, and are not easily thrown into subordinate groups. Most of the characters in the following analysis have been taken from adult individuals. Young examples in most cases differ from adults in the following respects, in addition to those characters which usually distinguish young fishes: The spines on the head are sharper, more conspicuous, and more compressed in the young, and some spines, especially those on side of head, disappear entirely with age. The interorbital space is more concave in the young. The pectoral fins are also much shorter. The gillrakers are longer in the young, and proportionately more slender, and some of the color markings—especially the darker cross-shades—are more conspicuous, while the spots on body and fins are less so.

Of the 21 recognized American species of the genus *Prionotus* 9 are known from the Pacific coast, 5 from the Atlantic coast of the United States, 5 (one of which is among those occurring on the Atlantic coast) from the Gulf of Mexico, while but 3 are known from the West Indies. The majority of the species are from rather deep water, and not many are taken in shore collecting.

a. Mouth comparatively small, maxillary less than a third length of head; mandible usually not extending backward as far as vertical from front of eye; generally a more or less distinct cross-groove on top of head behind eye; black spot on spinous dorsal usually more or less distinct.
b. Snout not distinctly birostrate, anterior profile usually not strongly concave.
c. Pectoral fin long, reaching past front of anal.
d. Pectoral fin not reaching base of caudal; gillrakers moderate, 8 or 10 developed; snout not strongly emarginate; no spine on cheek bone or edge of snout; dorsal spines 10.
e. Body not very slender, depth 5 in length; head not very small, its length 3 in body; groove across top of head behind eye, very conspicuous; interorbital area moderately concave, rather broad, about equal to diameter of eye; bones of head comparatively smooth; preocular, postocular, occipital, and nuchal spines low, depressed; temporal ridge conspicuous, without spines. Dorsal spines low, second 2.12 in head, first moderately serrate;

base of soft dorsal equal to distance from tip of snout to tip of humeral spine; caudal fin lunate, its outer ray one-eighth to one-fourth longer than inner; pectoral fin somewhat rounded, longest ray about the fifth; free rays of pectoral expanded toward tip, with decurrent membrane; scales rather large; about 58 pores. Body and fins nearly plain, mottled with darker, but without well-defined spots except dorsal ocellus; back with 4 obscure cross-blotches; 2 or 3 oblique pale streaks across spinous dorsal. Gill-membranes dusky. Young with head rougher, pectoral fins shorter, dark spots on body more distinct.. *carolinus*

ee. Body very slender, depth about 6 in length; groove across top of head behind eye, conspicuous; interorbital area narrow, deeply concave, its width about two-thirds the diameter of eye; bones of head very smooth, striations very weak; spines on top of head (preocular, supraocular, occipital, and nuchal) short and sharp, not depressed; temporal ridge blunt, without spine.

f. Pectoral short, reaching little past front of anal, not one-eighth length of body. Dorsal spines very high, second 1.75 in head, first moderately serrate; soft dorsal high, its base about one-fourth longer than head; caudal truncate; free rays of pectoral a little expanded at tip; 52 pores. Body covered with roundish bronze spots of various sizes; smaller bronze spots on head; both dorsals, caudal, and pectoral fins with similar bronze spots, these especially numerous and distinct on soft dorsal.. *scitulus*

ff. Pectoral longer, reaching past middle of anal, more than one-half body; pores 62; color rose-red, not spotted; pectoral dusky.. *roseus*

dd. Pectoral fin very long, reaching base of caudal, rays graduated; 50 pores in lateral line; gillrakers shortish, 1 + 6; body rather stout, depth 4 in length; palatine teeth few, feeble; caudal subtruncate; second dorsal spine longest, one-half length of head; first spine strongly serrated in front; preopercular spine with a smaller one at its base; head 2.5 in length. D. x-12; A. 11. Body with 4 faint crossbands; caudal with black tip and 2 paler cross-shades; spinous dorsal with small dark spots besides large one; soft dorsal plain; pectoral clouded...... *alatus*

PRIONOTUS:

aa. Mouth comparatively large, maxillary 2 to 2.75 in length of head, mandible extending backward to opposite eye, or nearly so; usually no distinct cross-groove on top of head; free rays of pectoral tapering, not expanded at tip; black blotch on spinous dorsal diffuse, not ocellated, involving membranes of more than two spines.

g. Preopercular spine without a distinct smaller spine at its base in front.

h. Pectoral fin very long, reaching at least to beyond second third of soft dorsal.

i. Head not plane above, interorbital space more or less concave; dorsal spines 10.

j. Supraorbital cirrus wanting.

k. Pectoral very long, reaching in adult beyond base of dorsal and anal; interorbital space moderately concave, its width about four-fifths length of eye; no cirrus above eye; distance from supraocular spine to nuchal scales about equal to eye; supraocular and nuchal spines low; occipital spines wanting; temporal ridge sharp, ending in a blunt spine; preorbital projecting, strongly serrate; a blunt spine on each side of snout, behind serræ of preorbital; a blunt spine behind this above angle of mouth; no spine on cheek bone in adult; upper opercular spine almost obsolete; bones of head rather strongly striate, not granulate; gillrakers short; mouth moderate; scales rather large, about 52 pores. D. x-11; A. 10. First dorsal spine not much shorter than second, which is 2.2 in head; caudal very slightly concave; ventrals reaching a little past vent; head 3; depth 5. Color nearly plain-brownish, with darker clouds; no distinct spots anywhere on body or fins; pectoral marbled with paler.. *rubio*

jj. Supraorbital cirrus present, fringed. Interorbital space very deeply concave, its width about three-fifths length of eye; a fringed cirrus above eye; distance from supraocular spine to nuchal scales about one-half eye; occipital as well as nuchal spines distinct; temporal ridge with a small spine; no spine on cheek bone; bones of head with fine, sharply defined striæ, but no granulations; upper opercular spine well developed; scales moderate (about 50 pores). D. viii-13; A. 11. First dorsal spine longest, 1.5 in head; caudal subtruncate; pectoral nearly twice as long as head, reaching nearly to last rays of dorsal; ventrals about reaching to vent; head 3 in length; depth 4.5. Color crimson, nearly plain; caudal with 2 dark cross-shades.. *ophryas*

hh. Pectoral fin short, not reaching beyond middle of dorsal; head much smoother than in any other species, bones of head faintly striate, with small granulations; cranial spines little developed; supraocular, occipital, and temporal spines wholly wanting, there being only 3 pairs of spines on head; mouth large, maxillary 2 in head. Gillrakers short and thick in adult, slender in young, about 10 developed; interorbital space concave, rather broad, its width in adult rather more than length of eye; first dorsal spine granulated; caudal slightly lunate; pectoral subtruncate, second ray longest, as long as head in adult; scales large, 48 pores in lateral line. Head large, 2.66 in length; depth 3.66. D. x-12; A. 11. Color crimson, with darker clouds and small spots; both dorsals with dark cross-streaks; head and pectoral fin conspicuously reticulated with blackish (in adult); anal plain, whitish; free rays of pectoral unspotted.. *stearnsi*

gg. Preopercular spine with a distinct smaller one at base; gillrakers slender.

l. Cheek bone without distinct spine at center of radiation; edge of preorbital granular-serrate, without distinct spine, serræ about 12 in number on each side; temporal ridges roughish, but without spines; bones of head with striæ coarsely granular; mouth moderate, maxillary about 2.6 in head; head not very broad, spines above, except nuchal spines, not conspicuous; gillrakers long and slender, 15 to 20 developed; head 2.75 in length; depth about 4. D. x-12; A. 11. Coloration brownish; side with a very distinct dusky bronze band below lateral line and parallel with it, this becoming broken posteriorly into a series of roundish dark spots; some dark streaks and clouds below this stripe; fins with dark clouds, soft dorsal with 2 dark blotches which extend as bars on back; head with scattered dark spots; dusky area below eye.

m. Pectoral with its rays each crossed by fine black bars, these especially distinct toward base of fin; free rays spotted; scales comparatively small, 10 + 1 + 23 in a vertical line from last dorsal spine to vent; interorbital area broad and almost flat, its width a little more than length of eye; first dorsal spine granulated; second spine 2.75 in head; pectoral about one-half length of body.. *strigatus* *mm.* Pectoral fin with its rays all plain-blackish; free rays plain-dusky; scales larger, 8 + 1 + 21 in a vertical line from last dorsal spine to vent; interorbital space more deeply concave, its width in adult not quite length of eye; first dorsal spine nearly smooth; second spine 3 in head; pectoral a little more than one-half body .... *evolans*

ll. Cheek bone with a spine (small in adult, larger in young) at center of radiation, this rarely obsolete in old examples.

n. Spines on bones of head moderate, not knife-like; preorbital with a series of serræ and one or more bluntish spines.

o. First 3 dorsal spines little if at all serrate. Back obscurely spotted; dorsal and caudal fins spotted with brown, first dorsal with a black blotch, pectoral with obscure dark spots, and margined with blue .... *punctatus*, 238

oo. First 3 dorsal spines more or less serrate. Color brownish-yellow; spinous dorsal with a black blotch; pectoral with 2 longitudinal broad dark areas separated and surrounded by paler .... *beanii*

nn. Spines on bones of head elevated, knife-like; head very large, more than two-fifths length; temporal ridge with 2 bluntish spines; bones of head very sharply striate; young with 4 sharp, knife-like spines on side of cheek and snout, in a line before preocular spine, these nearly disappearing with age; maxillary about 2.33 in head; side without dark longitudinal stripe.

p. Pectoral fin moderate, about one-half body in adult, 2.5 in young; gillrakers slender in young, becoming shorter and thicker with age, about 10 developed on lower part of arch; head broad, spines on its upper surface very prominent, all of them more or less compressed and knife-like, especially in young. Second dorsal spine 2.5 in head; head 2.33; depth 4.33. D. x–12; A. 11. Body brownish, much mottled with grayish and dusky, and with 3 or 4 obscure dark crossbands; head and dorsal fins with many dark spots; caudal with 2 dusky shades; free rays of pectoral spotted .... *tribulus*

238. **Prionotus punctatus** (Bloch). *Gurnard.*

Head 2.8; depth 2.8; eye 6 in head. D. x–12; A. 12; about 50 pores in lateral line. Body stout; head large; preopercular spine with smaller one at its base; pectoral reaching past middle of anal, its length not quite one-half body; gillrakers rather long and slender, about 10 developed; maxillary 2.5 in head; a bluntish spine on edge of snout behind serræ; behind this 1 or 2 smaller ones, at least in young; no spine on cheek bone; groove behind eye evident; interorbital area rather narrow, concave; preocular, supraocular, occipital, and nuchal spines rather prominent; dorsal spines high, third 2.33 in head; first spine not serrate; mouth large, maxillary 2.5 to 2.4 in head, and reaching nearly to eye; a small spine on center of radiation of cheek and one before it.

Color, nearly plain; spinous dorsal with dark clouds and without black ocelli; pectoral dark, with some round brown spots above; caudal dark-barred; a whitish area on back between dorsals. Our description is taken from two small specimens collected (probably at Tuxpan) on the east coast of Mexico, by Mr. T. Salt; from specimens in museum at Paris, the types of Cuvier & Valenciennes, and from a specimen taken by the *Albatross* at Bahia. This species is certainly the *Prionotus punctatus* of Cuvier & Valenciennes, but it may not be the species figured by Plumier, to which Bloch has given the name of *Trigla punctata*. The figure of Plumier shows a bright-red body, with many small spots of a darker red, while red spots are scattered all over the fins, except spinous dorsal and ventrals. In general form and in the armature of head, so far as this is shown in the plate, Plumier's figure most resembles the present species, but the red color suggests a possibility that some of the deep-water species may have been intended. The present species corresponds better to the figure than any other yet known. Bloch's figure of *Trigla carolina*, which has been identified with *P. punctatus*, is almost certainly *P. tribulus*. (Jordan & Evermann.)

Found in the West Indies and on the coast of South America; not known from the coasts of the United States; not common in Porto Rico, specimens (all small) being at hand from Mayaguez, station 6059, off Mayaguez in 7 fathoms, Hucares, and Isabel Segunda.

Trigla punctata Bloch, Ichthyol., pl. 353, 1793, Martinique; on a drawing by Plumier.
Prionotus punctatus, Poey, Fauna Puerto-Riqueña, 324, 1881; Stahl, l. c., 78 and 164; Jordan & Evermann, l. c., 2169, 1898.

Family LXIV. PERISTEDIIDÆ. The Deep-water Gurnards.

Body elongate, fusiform, covered with bony plates, each of which is armed with a strong spine; head bony; each preorbital produced into a long, flat process, which projects more or less beyond mouth; mouth small, inferior, like that of a sturgeon; teeth none; lower jaw provided with barbels; gill-membranes separate, narrowly joined to the isthmus anteriorly; gillrakers slender. Dorsal fin continuous or divided. Pectoral fin short, with 2 lowermost rays detached. Ventrals I, 5, separated by a broad, flat area. Air-bladder simple. Pyloric cæca about 10. Color generally red.

Deep-sea fishes, comprising 2 or 3 genera and about 13 species, bearing some resemblance to young sturgeons.

a. Barbels at angle of mouth in large tufts of fringes .... PERISTEDION, 131

aa. Barbels at angle of mouth minute, simple or nearly so .... VULSICULUS

Genus 131. PERISTEDION Lacépède.

Barbels large, forming large fringed tufts at angles of mouth and on lower jaw. Dorsal fins 2; characters otherwise included above.

Of the ten or a dozen known species of this genus only four occur in American waters. The first of these (*P. miniatum* Goode) is known only from the type locality, which is in the Gulf Stream off Rhode Island; the second (*P. longispathum* Goode & Bean) is known from Blake station LVIII, off Havana, in 242 fathoms (type locality), Blake stations LXII and LXIII, each off Barbados and each in 209 fathoms, and from the following Albatross stations in the Gulf of Mexico: 2397 in 280 fathoms; 2376 in 324 fathoms, and 2358 in 222 fathoms; the third (*P. platycephalum* Goode & Bean) is known only from 2 specimens, the type from Blake station LX, off Barbados, in 123 fathoms, and one other from Blake station LIX, off Barbados, in 288 fathoms; and the fourth species (*P. gracile* Goode & Bean) is also known from but two specimens, the type collected by the *Albatross* at station 2401 in the Gulf of Mexico in 142 fathoms, and the single specimen obtained by us in Porto Rico. A fifth species (*P. truncatum* Günther) was dredged by the *Challenger* at station 122, off Pernambuco, Brazil, in 30 or 350 fathoms, or in some intermediate depth; and a single specimen of a species in the closely related genus *Vulsiculus* Jordan & Evermann (*V. imberbis* Poey) was obtained by Poey from the stomach of a barbudo (*Polymixia lowei* Günther) taken near Havana in deep water.

The other species of *Peristedion* are known from the Mediterranean, Amboina, Japan, Molucca, etc. It will be noticed that all are deep-water species and that but little is known about any of them.

a. Body rather robust, depth 4.5 to 5 in length to base of caudal; head about 2.5 in length; barbels long.
  b. Length of preorbital extension about 3.5 in snout; color uniform crimson .... *miniatum*
  bb. Length of preorbital extension 2 in snout; color red, with a black blotch near tip of pectoral and black on caudal. *longispathum*
aa. Body slender, depth 6 to 6.5 in length to base of caudal; head 3 to 3.5; barbels moderate; fins mottled or blotched.
  c. Body very slender; preorbital process 2.25 in snout; color yellowish; a pearly lateral band; back dotted; fins mottled .... *gracile*, 239
  cc. Body much depressed; preorbital process 3 in snout; color red, mottled and blotched .... *platycephalum*

239. Peristedion gracile Goode & Bean. *Deep-water Gurnard.*

(PLATE 44.)

Head (measured from base of rostral prolongation to tip of opercular spine) 3; depth 6.5; width of head 6; eye 4; snout (without spine) 2.1; rostral prolongation or spine 3.6; D. VII–19; A. I, 19; branchiostegals 8; interorbital space deeply concave, 1.2 in eye. Body slender, heavy forward; profile from tip of snout to eyes straight or slightly concave; orbital ridges strong, high; rostral spine continued backward on each side in a sharp, thin ridge, ending in a blunt spine on lower part of opercle, a similar ridge diverging from it at angle of mouth and ending in a similar spine lower down; width between bases of rostral spines 1.5 in eye; opercular spine small, length of opercle and its spine scarcely equal to eye; jaws feeble and toothless; lower jaw with an irregular group of fringed barbels on each side, longest about twice length of eye; gillrakers 26 on first arch, the longest 2 in eye. Spinous dorsal originating above opercular spine, second spine longest, 2.5 in head, or equaling length of rostral spine; longest dorsal rays 1.5 in rostral spine; origin of anal under that of soft dorsal; longest anal ray equal to those of dorsal; base of anal more than 5 times as long as interorbital width; caudal somewhat forked, the lobes rounded; pectoral long, the lower rays detached, length of fin 1.6 in head; ventral 1.75 in head; bony plates of body strong, spines sharp, their surfaces rough, the number of spines in each series, beginning with the uppermost, about 26, 32, 26, and 27.

Color in life: Whitish, with pale-rosy wash, strongest on top of head and anterior part of body; side of head and body with faint greenish blotches; similar yellowish blotches in same region; tip of lower jaw red; dorsal fin pale with a broad rosy bar on membrane about at middle of height in spinous dorsal, somewhat narrower and higher up in soft dorsal; caudal pale at base, outer third rosy-red; anal pale; ventral pale; pectoral pale, crossed by about 5 series of rosy-red spots.

So rapidly do such fishes as this change color when brought up from considerable depths that we can never be sure that the colors they exhibit when we first behold them are really those which they possess in the depths which they inhabit; in fact we may be quite sure the colors are not the same, but whether the colors are more or less intense is difficult to determine. The specimen here described had a rather faded appearance when first seen, and very soon became still paler, and it is perhaps a safe inference that the natural color, particularly the red and green, was more pronounced.

This fish attains a length of 5 or 6 inches. Until now it has been known only from the type collected by the *Albatross* in the Gulf of Mexico. We obtained a single specimen, 5.5 inches long, dredged at station 6070, in Mayaguez Harbor, January 20, in 225 fathoms, on rocky bottom.

Peristedion gracile Goode & Bean, Oceanic Ichthyology, 473, pl. CXIV, fig. 387, 1896, Gulf of Mexico, in 142 fathoms, lat. 28° 82′ 30″ N., long. 85° 52′ 30″ W., at Albatross station 249; Jordan & Evermann, l. c., 2179, 1898.

Family LXV. CEPHALACANTHIDÆ. The Flying Gurnards.

Body elongate, subquadrangular, tapering behind; head very blunt, quadrangular, its surface almost entirely bony; nasals, preorbitals, suborbitals, and bones of top of head united into a shield; nuchal part of shield on each side produced backward in a bony ridge, ending in a strong spine, which reaches past front of dorsal; interocular space deeply concave; preorbitals forming a projecting roof above jaws; preopercle produced in a very long, rough spine; cheek and opercles with small scales; opercle smaller than eye; gill-openings narrow, vertical, separated by a very broad, scaly isthmus; pseudobranchiæ large; gillrakers minute; mouth small, lower jaw included; jaws with granular teeth; no teeth on vomer or palatines; scales bony, strongly keeled; 2 serrated, knife-like appendages at base of tail; first dorsal of 4 or 5 rather high flexible spines, first 1 or 2 spines nearly free from others; an immovable spine between dorsals; anal and second dorsal short, of slender rays; caudal small, lunate; pectoral fin divided to base into 2 parts, anterior portion about as long as head, of about 6 rays, closely connected; posterior and larger portion more than twice length of head, reaching nearly to caudal in adult (*Dactylopterus*), much shorter in young (*Cephalacanthus*), these rays very slender, simple, wide apart at tip; ventral rays I, 4, long, fins pointed, their bases close together, the inner rays shortest; air-bladder with 2 lateral parts, each with a large muscle; pyloric cæca numerous; vertebræ 9 + 13 = 22. Inhabitants of the warm seas; the adult able to move in the air like the true flying-fish, but for shorter distances. One genus.

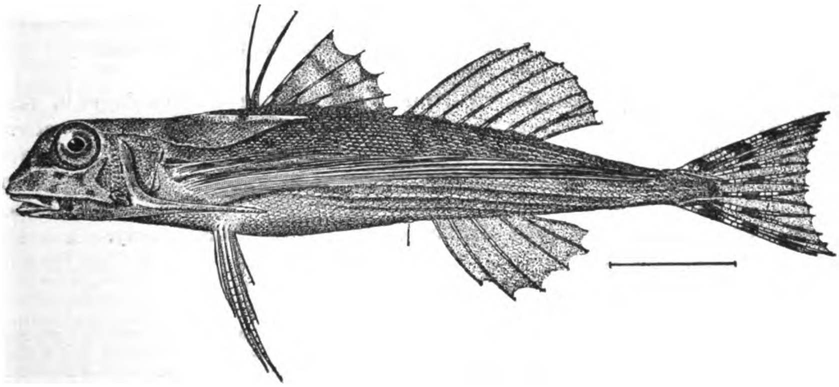

FIG. 86.—*Cephalacanthus volitans.*

Genus 132. CEPHALACANTHUS Lacépède.

Characters of the genus included above. Two species known, the following and the East Indian *Cephalacanthus spinarella.*

240. Cephalacanthus volitans (Linnæus). *Flying Robin; Bat-fish; Volador; Murciélago.*

Head 4.33; depth 5.5; D. II–IV, 8; A. 6; P. 28 + 6. First 2 dorsal spines free, slightly connected by membrane at base; preopercular spine reaching beyond base of pectoral, not to end of occipital spine; pectoral reaching nearly to base of caudal in adult, very much shorter in young; in the young the spines of head are much longer.

Color, greenish-olive and brown above, of varying shades; below pale, marked irregularly with dusky and bright brick-red, varying to a salmon-yellow; pectoral fin mottled with bright-blue streaks near the base and blue spots and bars toward tip, the under side glaucous-blue, edged with darker; caudal fin with about 3 brownish-red bars; coloration extremely variable.

This handsome and singular fish attains a length of 12 inches. It is found in the Atlantic Ocean, on both coasts, and is abundant on the South Atlantic and Gulf coasts. It has been recorded from Tortugas, Pensacola, St. Augustine, Cuba, and Jamaica; not seen by us in Porto Rico, but recorded from there by Professor Poey and Dr. Stahl.

Pirabebé Marcgrave, Hist. Brasil., IV, 162, 1648, Brazil.
Milvus cirratus Sloane, Hist. Jamaica, II, 288, Jamaica.
Trigla digitis vicenis palmatis Artedi, Genera, 44, 1738, Mediterranean, etc.
Hirundo Catesby, Nat. Hist. Carolina, II, tab. 8, Bahamas.
Trigla volitans Linnæus, Syst. Nat., ed. X, I, 302, 1758: after Artedi: "Mari Mediterraneo, Oceano, Pelago inter tropicos, in Asia ad Cap. b. Spei. Sæpi agitata evolans ex aqua."
Trigla tentabunda Walbaum, Artedi, Piscium, III, 362, 1792; after *Cataphractus* Klein, Missus, which is after Catesby, Fishes of Carolina, IV, 44, taf. 14, f. 1.
Trigla fasciata Bloch & Schneider, Syst. Ichth., 16, tab. 3, f. 1, 1801; after *Corystion* Klein, Missus, IV, 45, taf. 14, f. 2, locality not stated.
Dactylopterus pirapeda Lacépède, Hist. Nat. Poiss., III, 326, 1802, Mediterranean and almost all warm seas.
Polynemus sexradiatus Mitchill, Trans. Lit. and Phil. Soc., I, 1815, pl. 4, f. 10, New York.
Dactylopterus volitans, Poey, Fauna Puerto-Riqueña, 323, 1881; Stahl, l. c., 78 and 164, 1883.
Cephalacanthus volitans, Jordan & Evermann, l. c., 2183, 1898.

Family LXVI. GOBIIDÆ. The Gobies.

Body oblong or elongate, naked or covered with ctenoid or cycloid scales. Dentition various, the teeth generally small; premaxillaries protractile; suborbital without bony stay. Skin of head continuous with covering of eyes. Opercle unarmed; preopercle unarmed or with a short spine; pseudobranchiæ present. Gills 4, a slit behind fourth; gill-membranes united to isthmus, gill-openings thus restricted to sides. No lateral line. Dorsal fins separate or connected, spinous dorsal least developed, of 2 to 8 flexible spines, rarely wanting; anal usually with a single weak spine, similar to soft dorsal; ventral fins close together, separate or fully united, each composed of a short spine and 5 (rarely 4) soft rays, inner rays longest; ventral fins, when united, form a sucking disk, a cross-fold of skin at their base completing the cup; caudal fin convex; anal papilla prominent. No pyloric cæca; usually no air-bladder.

Carnivorous fishes, mostly of small size, living on the bottoms near the shores in warm regions. Some inhabit fresh waters, and others live indiscriminately in either fresh or salt water. Many of them bury in the mud of estuaries. Few of them are large enough to be of much value as food. The family embraces about 80 genera and nearly 600 species. The species are for the most part easily recognized, but their arrangement in genera is extremely difficult. Until the many Asiatic forms are critically studied, any definition of the American genera must be tentative only.

a. Ventral fins separate; body scaly.
OXYMETOPONTINÆ:
b. Ventral rays, I, 4.
c. Forehead bluntly rounded, without sharp keel; tongue very slender, sharp; body elongate, compressed, covered with very small scales; head short, compressed, rather broad above, mouth oblique, lower jaw projecting; teeth in few series, some of them canine-like; isthmus narrow. Dorsals separate, the first of six slender spines; soft dorsal and anal elongate; caudal lanceolate .... IOGLOSSUS
ELEOTRIDINÆ:
bb. Ventral rays I, 5.
d. Vomer with a broad patch of villiform teeth; gill-openings extending forward to below posterior angle of mouth, isthmus thus very narrow; skull above with conspicuous elevated ridges, one of these bounding orbit above, orbital ridges connected posteriorly above by a strong cross ridge .... PHILYPNUS, 133
dd. Vomer without teeth; isthmus broad; gill-openings scarcely extending forward below to posterior angle of preopercle; skull without crests.
e. Body scaly, both anteriorly and posteriorly.
f. Lower pharyngeal teeth stiff and blunt; bones with an outer series of broad flexible lamelliform appendages, which are rudimentary gill-filaments; body short and elevated .... DORMITATOR, 134
ff. Lower pharyngeals normal, subtriangular, teeth stiff, villiform, no lamelliform appendages; scales of moderate or small size; body oblong or elongate.
g. Body moderately robust, depth 4 to 5.5 times in length to base of caudal; scales ctenoid; cranium without distinct median keel; a small supraoccipital crest.
h. Post-temporal bones little divergent, not inserted close together, distance between their insertions greater than moderate interorbital space, or 3.8 in length of head; top of skull little gibbous; lower pharyngeals narrower than in *Eleotris;* preopercle without spine, scales very small, about 110 in a longitudinal series. Vertebræ 11 + 13; teeth moderate, outer series on lower jaw enlarged .... GUAVINA, 135

hh. Post-temporal bones very strongly divergent, their insertions close together, distance between them about two-thirds the narrow interorbital space, and less than one-seventh length of head; top of skull somewhat elevated and declivous; interorbital area somewhat convex transversely; lower pharyngeals rather broad, teeth bluntish; preopercle with partly concealed spine directed downward and forward at its angle; scales moderate, 45 to 60 in a longitudinal series .... ELEOTRIS, 136

gg. Body very slender, elongate, depth 8 to 9 times in length to base of caudal; scales very small, cycloid.

i. Preopercle without spine; caudal without many accessory rays at base; post-temporal bones short, strongly divergent, distance between their insertions about equal to narrow interorbital space, or about one-sixth length of head; top of head with a strong median keel, which is highest on occipital region; no supraoccipital crest, mouth very oblique; teeth small .... EROTELIS

aa. Ventral fins united.

j. Dorsal fins separate, free from caudal.

SICYDIINÆ:

k. Ventral disk short, adnate to belly; body subcylindrical, covered with ctenoid scales; lips very thick; upper teeth mostly small and movable, lower fixed; dorsal spines 6. Teeth simple; no canines in front of lower jaw. SICYDIUM, 137

GOBIINÆ:

kk. Ventral disk free from the belly.

l. Dorsal spines 4 to 8; eyes well developed.

m. Teeth emarginate, uniserial, those of lower jaw nearly horizontal; dorsal spines 6; scales large, ctenoid; gill-openings moderate .... EVORTHODUS

mm. Teeth simple.

n. Body scaly, more or less.

o. Maxillary normal, not prolonged behind rictus; skull of usual gobioid form, comparatively short and abruptly broadened behind orbits; occiput depressed; supraoccipital and temporal ridges continuous.

p. Dorsal spines 6; scales evidently ctenoid; head naked (nape scaly as usual).

q. Interorbital area anteriorly elevated, with a large foramen-like depression in front of eye; body short, compressed, formed much as in *Dormitator;* nape with a fleshy crest; scales large. Vertebræ 11 + 15.......... LOPHOGOBIUS

qq. Interorbital area not elevated in front; body more elongate; no fleshy nuchal crest; isthmus broad.

r. Inner edge of the shoulder-girdle without fleshy cirri or papillæ; cranium anteriorly short; interorbital space narrower, grooved, with a low median ridge or none; median crest on cranium low.

s. Body scaly anteriorly and posteriorly (sometimes a naked strip on back or belly). Vertebræ 12 + 16 to 10 + 15 .... GOBIUS, 138

ss. Body entirely naked anteriorly, posterior half scaled; scales moderate or small.......... GARMANNIA

rr. Inner edge of shoulder-girdle with 2 or 3 conspicuous dermal flaps; preorbital region very long; premaxillary and maxillary strong; interorbital groove with a conspicuous median crest; scales rather small (45 to 70). AWAOUS, 139

pp. Dorsal spines 7 or 8 (very rarely 6, especially in *Eucyclogobius*).

t. Scales large, ctenoid; shoulder-girdle without dermal flaps. Sides of head scaled; soft dorsal and anal rather short, of 11 to 14 rays each; deep-water species .... BOLLMANNIA, 140

tt. Scales very small, cycloid or nearly so. Inner edge of shoulder-girdle without fleshy processes; head naked; body more or less compressed; mouth very oblique; teeth strong; interorbital groove with or without a median ridge. Vertebræ 11+15 or 16; soft dorsal and anal long, of 15 to 17 rays each. Body chiefly scaly, anteriorly as well as posteriorly .... MICROGOBIUS, 141

nn. Body and head entirely naked. Dorsal spines 7 (rarely 6).

u. Chin without barbels; mouth small, little oblique; body robust, soft dorsal and anal short.......... GOBIOSOMA

uu. Chin with a fringe of short barbels; mouth terminal, oblique; soft dorsal and anal very short.......... BARBULIFER

jj. Dorsal fin continuous, soft part and anal joined to base of caudal; eye minute; body elongate; scales minute or wanting; mouth very oblique, lower jaw projecting; gill-openings moderate.

v. Dorsal rays VI, 16 to 23; anal rays 17 to 23. Teeth in a band, those of outer series being very strong; scales present.

w. Body entirely scaled .... GOBIOIDES, 142

ww. Anterior part of body naked .... CAYENNIA

Genus 133. PHILYPNUS Cuvier & Valenciennes. Guavinas.

Body elongate, terete anteriorly, compressed behind. Head elongate, depressed above. Mouth large; lower jaw considerably projecting; teeth in jaws rather small, slender, recurved, outer scarcely enlarged; teeth on vomer villiform, in a broad, crescent-shaped patch; gill-openings extending forward to below posterior angle of mouth, isthmus very narrow. Scales moderate, ctenoid, covering most of head, 55 to 66 in a longitudinal series. Dorsal with 6 spines and 9 or 10 rays; anal rays I, 9 or 10; ventrals separate. No preopercular spine; insertion of post-temporals almost midway between occipital crest and edge of skull; parietals with a crest running from insertion of post-temporal forward to just behind eye, where they are connected by a thin, high, transverse crest; supraocular with a short, high crest, extending from above front of eye back to posterior edge of orbit, thence extending outward parallel with transverse crest, leaving a deep groove between them; bony projections before and behind eye prominent. Vertebræ 12 + 13=25; lower pharyngeals triangular, with slender teeth.

The fishes of this genus are the largest of the gobies, some reaching a length of 2 or 3 feet and being valued as food. Found in tropical rivers.

241. **Philypnus dormitor** (Lacépède). "*Guavina.*"

Head 3; depth 5; eye 9.75; snout 3; maxillary 2.2; mandible 2.1; interorbital width 3.8; preorbital 9.5; D. vi–12; A. i, 10; scales about 61–23. Body long, subterete; head long, broad, depressed; snout long, lower jaw strongly projecting, the point a broad angle; mouth large, somewhat oblique, maxillary very long, reaching posterior border of orbit; eye nearly on level with top of head; cheeks full; teeth in each jaw in broad cardiform bands; vomerine teeth in a broad crescent-shaped patch; gillrakers 4 + 11, very short, covered with fine prickles or spines, especially on their posterior surface. Fins all large; dorsal fins separated by a space less than half diameter of orbit, spines flexible, longest about equal to snout and eye; last rays of second dorsal longest, somewhat longer than snout and eye, about 2 in head; caudal fin rounded, convex, the middle rays about 1.5 in head; last anal ray longest, a little shorter than last dorsal rays; pectoral broad, broadly pointed, with about 17 rays, middle ones longest, about 1.8 in head, reaching beyond tips of ventrals; ventrals i, 5, about 2.2 in head, their tips reaching less than two-thirds distance to vent.

Color in life: Dark-yellowish or olive-brownish, back darkest, belly most yellow; sides with extensions of the dark of back; head dark, with a few small dark specks; arrangement of colors presenting a mottled appearance as on body; fins all mottled with brown and yellowish, no dark border to spinous dorsal; base of pectoral dark; ventrals paler.

This large goby is everywhere common in the fresh-water streams of the West Indies and the Atlantic shores of Mexico, Central America, and Surinam. It seems to be an abundant fish in all the larger streams of Porto Rico, specimens having been obtained by us from the Rio Loiza and Rio de Caguitas near Caguas, and from the Rio Bayamon at Bayamon and near Palo Seco. It has been recorded from Havana, Martinique, Jamaica, Mexico, and Nicaragua. It reaches a length of 2 feet or more, and is one of the most important fresh-water food-fishes in Porto Rico and elsewhere in the West Indies. The examples obtained by us are 4 to 17 inches long.

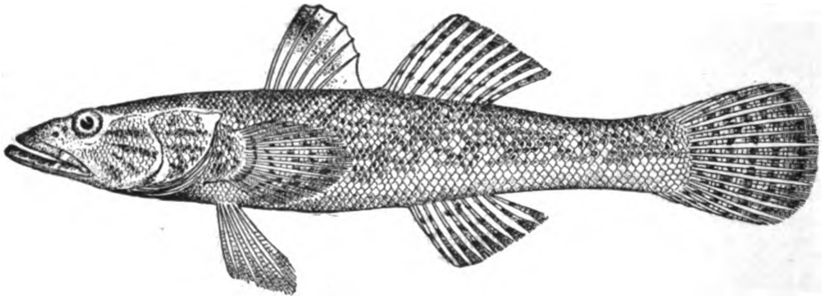

FIG. 87.—*Philypnus dormitor.*

Guavina, Parra, Descr. Dif. Piezas, Hist. Nat. Cuba, tab. 39, fig. 1, 1787, Havana.
Gobiomorus dormitor Lacépède, Hist. Nat. Poiss., II, 599, 1798, Martinique; from a drawing by Plumier.
Platycephalus dormitator Bloch, Syst. Ichth., pl. 12, 1790, Martinique; after Lacépède.
Batrachus guavina Bloch & Schneider, Syst. Ichth., 44, 1801; based on *Guavina* of Parra.
Eleotris longiceps Günther, Proc. Zool. Soc. Lond. 1864, 151, Nicaragua.
Eleotris dormitatrix Cuvier, Règne Animal, ed. II, vol. 2, 246, 1829, Antilles.
Philypnus dormitator, Poey, Fauna Puerto-Riqueña, 339, 1881; Stahl, l. c., 79 and 165, 1883.
Philypnus dormitor, Jordan & Evermann, l. c., 2194, 1898.

Genus 134. DORMITATOR Gill. Puñecas.

Body short, robust; head broad and flat above; mouth little oblique; maxillary reaching to anterior margin of orbit; lower jaw little projecting; no teeth on vomer; lower pharyngeal teeth stiff and blunt, the bones with an external series broad, flexible, lamelliform, these being rudimentary gill-filaments; scales large, ctenoid, 30 to 33 in a longitudinal series; skull much as in *Eleotris;* D. vii–i, 8; A. i, 9 or 10; no spine on preopercle; post-temporals inserted midway between occipital crest and edge of skull; supraoccipital crest low.

242. Dormitator maculatus (Bloch). *Masaguan; Mapiro.*

(PLATE 45.)

Head 3.5; depth 3.5; eye 5.75; snout 4.5; maxillary 3; mandible 3.2; interorbital 2; preorbital 6.5; scales 33,-12; D. VIII-9; A. I, 9; longest dorsal spine 1.9; longest dorsal ray 1.1; longest anal ray 1.2; pectoral 1.2; ventral 1.25; caudal 1. Body short and stout, heavy forward; head broad, flat above, interorbital space wide; caudal peduncle long, rather compressed, length 1.4 in head; profile gently and regularly arched from tip of snout to origin of dorsal, from which point body tapers to caudal peduncle. Mouth small, considerably oblique, upper lip on level with pupil; maxillary reaching vertical at front of orbit; lower jaw scarcely projecting; teeth on jaws short and weak, in villiform patches; no teeth on vomer. Fins all large; interspace between dorsals very narrow, less than orbit; soft dorsal and anal, when depressed, reaching beyond base of caudal, which is rounded. Scales large, smaller on head and belly, about 15 series from base of ventral to vent, 14 series across breast between bases of pectorals, and about 25 from tip of snout to origin of dorsal fin; origin of dorsal fin midway between tip of snout and posterior base of soft dorsal.

Color in life: Pale-greenish on head and back, lower sides and belly pale-bluish; sides of head and back mottled with darker; a narrow dark line from eye downward and forward to mouth, and 2 or 3 similar but broader bands from eye to posterior edge of opercle, these bands more or less broken; dorsal fins brownish, barred with narrower white bands, each with a narrow brick-red edge; anal banded with light brick-red and narrower white interspaces; edge of fin pale, with a subterminal dark bar; caudal, ventral, and pectoral pale; iris brick-red. In alcohol this fish becomes quite dark, almost black, the bright colors changing completely.

This description is from numerous specimens 6 to 8 inches long, but the species reaches a length of 1 to 2 feet and is a valued and important food-fish. It is found on both coasts of tropical America, ranging from South Carolina through the West Indies to Para, and from Cape San Lucas to Panama; usually abundant. On the coast of Florida it has been taken at Hillsboro River, Indian River Inlet, and on the Pensacola Snapper Banks. No adults were seen by us in Porto Rico, but we collected one young specimen at Mayaguez, and on February 15 we obtained 85 near Hucares from a small, shallow lagoon bordered with mangrove bushes, filled with decayed vegetation, and with the water strongly colored. These specimens varied in length from 3 to 8 inches.

Sciæna maculata Bloch, Syst. Ichth., pl. 299, fig. 2, 1790, West Indies.
Eleotris mugiloides Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 226, 1837, Martinique and Surinam.
Eleotris sima Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 232, 1837, Vera Cruz.
Eleotris latifrons Richardson, Voy. Sulphur, Fishes, 57, pl. 35, figs. 4 and 5, 1837, locality unknown, probably Pacific coast of Central America.
?*Eleotris grandisquama* Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 229, 1837, America.
Eleotris somnolentus Girard, Proc. Ac. Nat. Sci. Phila. 1858, 169, near mouth of Rio Grande, Texas.
Eleotris omocyaneus Poey, Memorias, II, 269, Havana.
Dormitator microphthalmus Gill, Proc. Ac. Nat. Sci. Phila. 1863, 170, Panama.
Dormitator gundlachi Poey, Synopsis, 396, 1868, Cuba.
Dormitator lineatus Gill, Proc. Ac. Nat. Sci. Phila. 1863, 271, Savannah, Georgia.
Dormitator mugiloides, Poey, Fauna Puerto-Riqueña, 339, 1881; Stahl, l. c., 79 and 165, 1883.
Dormitator maculatus, Jordan & Evermann, l. c., 2196, 1898.

Genus 135. GUAVINA Bleeker. Morons.

This genus is allied to *Eleotris*, differing in having the post-temporal bones little divergent, not inserted close together, distance between their insertions greater than the moderate interorbital space, or 3.8 in length of head; top of skull little gibbous; lower pharyngeals narrower than in *Eleotris;* preopercle without spine; scales very small, ctenoid, about 110 in a longitudinal series. Vertebræ 11 + 13; teeth moderate, the outer series on lower jaw enlarged.

Inhabitants of the fresh waters of the West Indies and Brazil. Two species known—*Guavina brasiliensis* (Sauvage), from Bahia, and the following.

243. Guavina guavina (Cuvier & Valenciennes). "*Moron.*"

Head 3.5; depth 4.5; eye 6.5; snout 4; maxillary 2.25 to 2.5; mandible 2.5; interorbital 3 to 3.25; preorbital 7.2; scales about 100,-38; D. VII-12, the longest spine 2.5 to 3 in head, the longest soft ray about 2; A. I, 10, longest ray about 2 in head; pectoral 1.5; caudal 1.25 to 1.5. Body stoutish, oblong, heavy forward; head heavy, broad; mouth oblique, large, maxillaries reaching middle of eye, lower jaw slightly projecting; isthmus very broad, gill-opening not reaching farther forward than vertical opercle; preopercle smooth with concealed spine; caudal peduncle compressed, least width 3.75 in its least depth, which is 2 in head; teeth in broad bands, outer ones of lower jaw somewhat enlarged; dorsal outline rising gently from snout to origin of spinous dorsal; ventral line relatively straight; scales very small, those on head embedded and cycloid, those on back, belly, and anterior part of sides cycloid, on posterior part of body ctenoid; lower portion of preocular and cheek naked, upper portions with small embedded scales. Fins moderate; origin of spinous dorsal nearer tip of snout than posterior edge of soft dorsal by a distance equal to diameter of orbit; distance between spinous soft dorsal slightly greater than diameter of orbit; dorsal spines flexible; dorsal and anal rays when depressed barely reaching rudimentary caudal rays; caudal fin regularly rounded; tips of ventrals reaching halfway to origin of anal fin; tips of pectorals extending slightly beyond tips of ventrals.

Color, dark, marbled with darker and lighter; under parts dirty-whitish; fins dark like body, bordered with white, especially the dorsals and anal.

The moron reaches a foot in length and is a good food-fish. It is found on the east coast of tropical America from Cuba to Rio Janeiro, in fresh and brackish water, and is generally common. Only two examples (6.5 and 8.5 inches long) were seen in Porto Rico by us; they were obtained in the San Juan market January 15, and probably came from the mouth of the Bayamon River.

Eleotris guavina Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 223, 1837, Martinique.
Guavina guavina, Jordan & Evermann, Fishes of North and Middle America, 2198, 1898.

Genus 136. ELEOTRIS (Gronow) Bloch & Schneider.

Body long and low, compressed behind. Head long, low, flattened above, without spines or crests, almost everywhere scaly. Mouth large, oblique, lower jaw projecting. Lower pharyngeals rather broad, teeth small, bluntish. Preopercle with a small concealed spine below, its tip hooked forward. Branchiostegals unarmed. Eyes small, high, anterior; isthmus broad. Post-temporal bones very strongly divergent, their insertions close together, the distance between them about two-thirds the narrow interorbital space, and less than one-seventh length of head; top of skull somewhat elevated and declivous; interorbital area slightly convex transversely; the dorsal fins well separated, first of 6 or 7 flexible spines; ventrals separate. Scales moderate, ctenoid, 45 to 62 in longitudinal series; vertebræ (*pisonis*) 11 + 15.

Found in tropical seas, entering fresh waters.

a. Teeth subequal, those of inner or outer series enlarged.
b. Cheek entirely scaled.
c. Teeth of inner series of each jaw enlarged.
d. Scales in a median series 40 to 51, in a cross series 12 to 20.
e. Eye large, 5 to 6 in head; scales 40 to 44,—12 to 14 .... *amblyopsis*
ee. Eye small, 8 in head; scales 51,–20 .... *abacurus*
dd. Scales in a median series 57 to 66; in a cross series 18 to 24 .... *pisonis*, 244
bb. Lower half of cheek naked; scales 61 .... *perniger*

244. Eleotris pisonis (Gmelin). "*Moron.*"

Head 2.9; depth 3.75; eye 7; snout 5; maxillary 2.75; mandible 2.75; interorbital 3.6; preorbital 10; pectoral 1.4; ventral 2; caudal 1.4; D. vi–9, the longest spine 3 in head, the longest ray 2.5; A. i, 8, the longest ray 2.3; scales 57 to 63,–19 to 22; vertebræ 11 + 15. Body stout, not compressed; head broad, depressed, tapering forward; mouth large, oblique, maxillary reaching posterior border of pupil; eyes high up; isthmus moderately broad, gill-openings extending forward somewhat beyond angle of preopercle; preopercle with a strong concealed spine at angle, directed forward; no teeth on vomer or palatines; teeth on jaws in wide villiform bands, outer series somewhat enlarged; lower pharyngeals broad, triangular, without fringe, teeth bluntish; branchiostegals 6; gillrakers 2 + 9, very short; caudal peduncle compressed, its least width one-third its depth, which is 2 in head. Fins moderate; origin of spinous dorsal about midway between tip of snout and tip of dorsal rays; space separating dorsals scarcely more than half orbit; dorsal and anal rays not reaching base of caudal; ventrals inserted somewhat behind insertion of pectorals, their tips reaching halfway to origin of anal; pectoral reaching beyond ventrals. Scales small, crowded anteriorly, embedded on nape, head, and cheeks, ctenoid only on sides.

Color, dark-brown or blackish; sides with faint narrow dark lines alternating with narrow light ones; fins with dark wavy lines.

The range of this species is from Florida to Rio Janeiro; it is recorded from Pensacola, Rio Almendares (Cuba), Santo Domingo, Martinique, Surinam, and Rio Janeiro, and was found by us to be common in fresh and brackish waters of Porto Rico. In the Bayamon River 13 specimens were obtained January 12, varying in length from 3.5 to 6.25 inches. There is a single specimen, 1.5 inches long, from Mayaguez, January 20, and 3 small ones, from 1.31 to 2.06 inches long, from Arroyo. This species is known in Porto Rico only as "moron." It does not seem to be much used as food. It is apparently most common in the lower portions of rivers, and probably does not run to the headwaters.

Amore pixuma, Marcgrave & Piso, Hist. Brasil., IV, 166, 1648, Brazil.
Eleotris capite plagioplateo, Gronow, Mus. Ichth., II, 168, 1757; after Marcgrave & Piso.
Gobius pisonis Gmelin, Syst. Nat., 1206, 1788; based on *Eleotris* of Gronow.
Eleotris gyrinus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 220, pl. 356, 1837, Martinique, Santo Domingo and Surinam; Poey, Fauna Puerto-Riqueña, 339, 1881; Stahl, l. c., 79 and 165, 1883.
Eleotris* (*Culius*) *belizianus, Sauvage, Bull. Soc. Philom. Paris 1879, 55, Belize and Cayenne.
Eleotris pisonis, Jordan & Evermann, l. c., 2200, 1898.

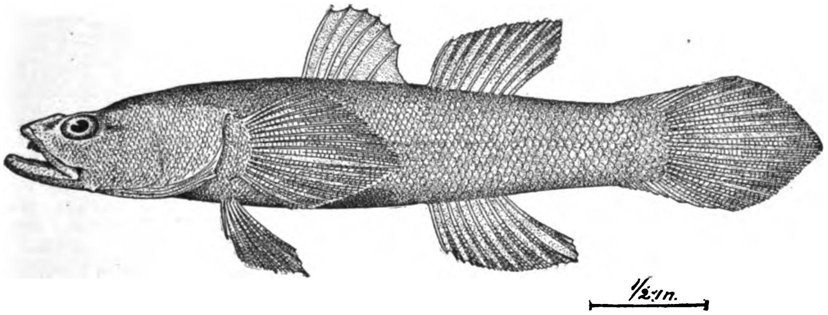

FIG. 88.—*Eleotris pisonis.*

Genus 137. SICYDIUM Cuvier & Valenciennes.

Body subcylindrical, covered with rather small ctenoid scales; head oblong and broad, with cleft of mouth nearly horizontal; upper jaw prominent; snout obtusely rounded; lips very thick, lower jaw with a series of numerous slender horizontal teeth, of which sometimes only the extremities are visible; upper jaw with a single uniform series of numerous movable small teeth attached by ligament to edge of maxillary; behind this outer visible series lie numerous other parallel series of young teeth hidden in the gum, which succeed the former as they become worn out or broken; lower jaw with a series of widely-set conical teeth; teeth all simple, slender, distal half bent inward nearly at a right angle; eyes of moderate size; 2 dorsal fins, anterior with 6 (5 or 7) flexible spines; caudal quite free; ventrals united into a short cup-shaped disk; gill-openings of moderate width; 4 branchiostegals.

Found in the streams of the West Indies. Few species.

a. Body usually well scaled.
  b. Scales large, about 56 in longitudinal series .... *punctatum*
  bb. Scales moderate, about 68.................... *antillarum*
  bbb. Scales small, about 84.
    c. Body densely scaled; no dark vertical bars on body.................... *caguitæ*, 245
    cc. Body less densely scaled; squamation sometimes quite incomplete; about 7 more or less distinct vertical bars on body.................... *plumieri*, 246
aa. Body nearly naked.................... *vincente*

245. Sicydium caguitæ Evermann & Marsh.

Head 4.4; depth 4.8; eye 5.75; snout 2.5; maxillary 2; mandible 2.75; interorbital width 3; preorbital 3.5; D. vi–i, 10; A. i, 9; scales 83,–25; longest dorsal spine 1.5 in head, longest ray 2; longest anal spine 2 in head, longest ray 2; pectoral 1.1; ventral disc 1.75; caudal 1. Body rather stout, heavy forward; head large, broad; mouth large, its width 1.5 in head; lips very thick; maxillary not greatly produced; teeth simple, flexible; a median cleft in upper lip; pectoral somewhat shorter than head; dorsal spines without filaments, longest about 1.5 in depth of body; space between dorsals about equal to orbit; soft rays of dorsal and anal scarcely reaching base of caudal; ventrals united, forming a cup-shaped disk, only about two-fifths posterior edge free from belly; caudal rounded. Scales very small, ctenoid, densely covering entire body except a broad strip on belly; posterior portion of nape with very fine scales; entire head naked.

Color, dark-brown or olivaceous on head, sides, and back; under parts pale; fins all pale, anal with a narrow darkish margin; caudal somewhat dark; no dark vertical bars on body and none at base of pectoral; no H-shaped figure at base of caudal.

This species is close to *S. plumieri*, from which it differs chiefly in color, the more complete squamation, the shorter pectoral, and the nonfilamentous character of dorsal spines. Known only from the type, 3.63 inches long, from the Rio de Caguitas at Caguas, Porto Rico.

Sicydium caguitæ Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 355, Rio de Caguitas, Caguas, Porto Rico.

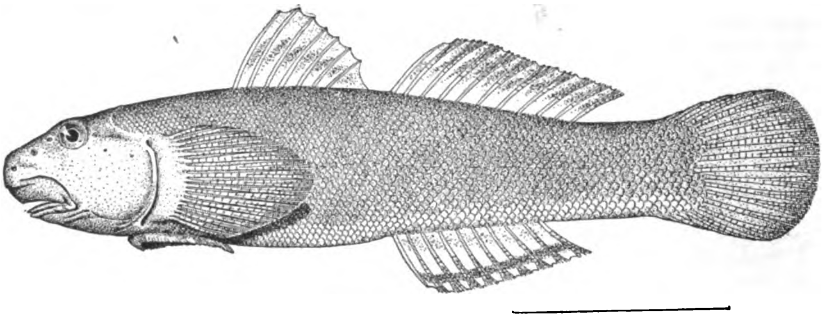

FIG. 89.—*Sicydium caguitæ*.

246. Sicydium plumieri (Bloch). *Sirajo.*

Head 4 to 4.6; depth 4.5; eye 6 to 7 in head, 2 to 3 in interorbital width; D. VI–I, 10; A. I, 10; scales 84. Teeth in upper jaw long, slender, bent inward at right angles, only tips protruding from gums. Front teeth of lower jaw not larger than those behind; a single row of inconspicuous papillæ on gum beneath upper lip, a large median papilla above maxillary suture; a median cleft in upper lip. Pectoral longer than head; third, fourth, and fifth dorsal spines produced into long ribbons, the fourth, which is longest, being 2 to 3 times height of body. Body usually covered with small scales, reduced in size on neck and belly; frequently almost naked, scales present only on posterior part of body. Caudal deeply emarginate.

Color, olive or violet-brown, with about 7 more or less distinct dark vertical bars; a dark bar at base of pectoral; dorsal with irregular dark markings; anal fin with a dark marginal band, sometimes edged with white; an H-shaped figure on base of caudal fin, and a black bar on its posterior half.

An inhabitant of the fresh waters of the West Indies. Not obtained by us in Porto Rico, but recorded by Professor Poey.

Gobius plumieri Bloch, Ichth., 125, pl. 178, fig. 3, 1786, Martinique; on a drawing by Plumier.
Sicydium siragus Poey, Memorias, II, 278, 1861, Santiago de Cuba.
Sicydium plumieri Poey, Fauna Puerto-Riqueña, 338, 1881; Jordan & Evermann, l. c., 2206, 1898.

Genus 138. GOBIUS (Artedi) Linnæus. Gobies.

Body oblong or elongate, compressed behind. Head oblong, more or less depressed. Eyes high, anterior, close together; opercles unarmed. Mouth moderate. Teeth on jaws only, conical, in several series, those in outer row enlarged; no canines. Isthmus broad. Shoulder-girdle without fleshy flaps or papillæ. Skull depressed, abruptly widened behind eyes and without distinct median keel. Scales moderate, ctenoid, permanently covering body; cheek usually naked; belly generally scaly. Dorsal with 6 rather weak spines; pectoral well developed, upper rays sometimes very slender and silky; ventrals completely united, not adnate to belly; caudal fin usually obtuse.

The genus *Gobius*, as here understood, comprises a very large number of species more or less closely related to the European type of the genus, *Gobius niger*, and its American relative, *Gobius soporator*. An examination of skulls or skeletons of numerous European and American species shows a remarkable uniformity in most respects. The general form and structure of the cranium is the same in all, the only differences being very minor ones in the height of certain crests. *Gobius oceanicus* seems most aberrant, but is difficult to separate generically on account of intermediate forms. Probably several of the many genera indicated by Bleeker will prove valid, but only a thorough study of skeletons can establish them. It is not unlikely that *Ctenogobius*, to which group most of our species belong, may be separable from *Gobius*.

GOBIUS:

a. Upper rays of pectoral fin silk-like; i. e., short and very slender and flexible, free for nearly their whole length.

b. Body robust, compressed posteriorly........................ *soporator*, 247

CTENOGOBIUS:

aa. Upper rays of pectoral normal, not silk-like, similar to others.

c. Scales large, 25 to 33. Color in life olivaceous, more or less spotted, never red.

d. Dorsal soft rays 12 to 14; vertex and nape with a slight median fold of skin. Body long, not much compressed; head 3.5; eye 3 in head; a dark spot on first dorsal........................ *eigenmanni*

dd. Dorsal soft rays 10 to 12.

e. Caudal with 2 spots at its base; jaws unequal, lower slightly produced; body robust, compressed behind, depth 5 in total length; head 4.33; eye longer than snout, 3.5 in head; maxillary reaching pupil; teeth in a band, the outer enlarged and distant, the inner enlarged and bent backward. Brownish; a faint blue spot on each scale; six spots along middle of back; similar spots on scapular region and middle of side; a dark spot above opercle; blue dots on head; a straight blue line crossing cheek above and continued on opercle; dorsals faintly spotted. D. VI-10; A. 10. Scales 25,-7........................ *glaucofrænum*

ee. Caudal plain or with but a single spot at its base.

f. Dorsal spines low, highest little longer than head.

g. Region from nape to dorsal entirely scaled.

h. Pores on preopercle not very conspicuous; no canine teeth. Body subfusiform, little compressed; depth 4.5 in length; head blunt, 4 in length, rounded in profile; eye equal to snout, 4 in head. Mouth small, horizontal, lower jaw included; maxillary 3 in head, reaching to below eye. Teeth small, in bands in both jaws, the outer enlarged, those of upper jaw very slender. Scales large, ctenoid, those of nape and belly little reduced. Longest dorsal spine shorter than head. Caudal scarcely pointed, about as long as head. Color, whitish-gray, middle of side with 4 or 5 dark blotches, from each of which a narrow dark bar extends downward and forward; a large black blotch above pectoral, obsolete in female; a small black spot at base of caudal; a dark mark below eye; vertical fins barred. D. VI-12; A. 11 or 12. Scales 33........................ *stigmaturus*

hh. Pores on preopercle very conspicuous; lower jaw with small canines. D. VI-I, 9; A. I, 9........................ *quadriporus*

gg. Region between nape and dorsal with a narrow naked median strip. Body moderately elongate, subfusiform, depth 5.33 in length. Head large, not so blunt as in *G. boleosoma*, 3.4 to 3.66 in length; anterior profile gently decurved; snout 3.33 to 3.5 in head; eye 4; mouth large, slightly oblique; maxillary extending to front of pupil, 2.33 in head. Teeth small, slender and curved, in moderate bands. Scales moderate, ctenoid, those in front much reduced in size; breast naked. Longest dorsal spine 1.5 in head. Caudal as long as head, somewhat pointed. Olivaceous, mottled with gray; about 5 rounded dark blotches along middle of side, last forming a spot at base of caudal; no dark spot on side of nape; some dark marks on head; vertical fins barred. D. VI-12; A. 13. Scales 33 to 35........................ *shufeldti*

ggg. Region between nape and dorsal entirely naked.

i. Highest rays of second dorsal little more than half head, none of them reaching base of caudal.

j. Profile much decurved, skull rounded behind, without distinct median ridge; mouth horizontal. Body elongate, deepest below front of dorsal, tapering regularly backward, greatest depth 5.5 in length. Head short, blunt, profile anteriorly abruptly decurved, cheek somewhat swollen. Length of head 3.5 in body. Snout about equal to eye, 3.66 in head. Mouth horizontal, maxillary reaching to below pupil (in male); lower jaw included. Teeth in each jaw in a band, outer row of upper jaw large, recurved. Scales large, ctenoid, somewhat reduced anteriorly. Nape, breast, and belly naked. Dorsal spines about two-thirds of head Caudal pointed, 2.66 to 3.5 in body. Color olivaceous, with numerous dark reticulations on back; 5 black spots along side, the last forming a spot on base of caudal, sometimes with V-shaped dark bars extending from them to dorsal; breast and sides of belly with numerous dark specks in male; a dark line between eyes; a dark line from eye to middle of premaxillary, some dark spots below eye, sometimes forming bars, sometimes a stripe; a large oblique spot above pectoral, continued on opercle; a black spot at base of pectoral; dorsals and caudal barred, anal uniform dusky, ventrals and pectoral black in male, white in female. D. VI-11; A. 10 to 12. Scales 25 to 30.. *boleosoma*

jj. Profile moderately decurved; eye longer than snout, 3.75 in head. Color yellowish, oblong dark blotches on middle of side; dorsal and caudal barred. Head 4; depth 6. D. VI-12; A. 10........................ *fasciatus*

ii. Highest rays of second dorsal as long as head, the last reaching base of caudal. Body elongate, back not arched; depth 6 in length; head 4, not compressed, cheek tumid. Profile abruptly decurved, the snout 3.33 in head. Mouth large, nearly horizontal, maxillary reaching posterior edge of eye in males, middle of eye in females. Teeth in narrow bands in each jaw, outer somewhat enlarged, outer in some (males?) much enlarged above and recurved, enlarged teeth fixed, others movable. Scales large, ctenoid, reduced anteriorly, belly naked. Dorsal spines little filamentous, longest about equal to head; caudal 2.25 to 3 in body. Males dark-olive, with 4 oblong dark blotches along middle of side; a dark caudal spot; a black blotch larger than eye on each side of shoulder; dorsal spotted; caudal reddish above, dusky below; females with 5 oblong dark blotches on side the last on base of caudal; from each of middle blotches a V-shaped bar runs to back; a black shoulder blotch, a dark bar from eye to mouth; ventrals pale, with 2 dark streaks. D. VI-11; A. 12. Scales 30 (27 to 33) at least in males........................ *encæomus* *ff.* Dorsal spines high, highest reaching past middle of second dorsal. Nape scaly. Body elongate, moderately compressed.

k. Depth 5 to 6 in length; profile little decurved, skull flattish behind, much broader than in *Gobius boleosoma*, with an evident median ridge; mouth very oblique, much larger than in *G. boleosoma;* lower jaw thin and flat. Back slightly arched. Body a little deeper and rather less compressed than in *G. encæomus*, depth 5 to 6 in length. Head 4. Anterior profile moderately decurved. Eye 3.33 in head. Mouth large, oblique; maxillary reaching to below pupil in both sexes. Teeth above uniserial, some of them enlarged and recurved; lower teeth in a narrow band; males sometimes with hindermost of outer series a strong, exserted, recurved canine; belly naked. Longest dorsal spine two-thirds head in females, elevated in males; soft dorsal elevated in males; caudal 3.5 in body. Color, light-greenish, sides of male with 5 or 6 narrow, straight, rather sharply defined whitish or yellowish crossbars, regularly placed; 4 dark bars, 3 below eye and 1 on opercle; a small dark spot behind and above opercle; vertical fins barred; female with a row of irregular dark spots connected by a dusky streak, and with pale crossbars obsolete. D. VI-12; A. 13. Scales 27.................... *stigmaticus*

kk. Depth 4.66 in length; profile very obtuse anteriorly; maxillary extending beyond pupil, 2.6 in head. Teeth strong, uniserial, 4 shortish canines in lower jaw behind other teeth; upper teeth largest. D. VI-11; A. 10. *lyricus*, 248

kkk. Depth 4 in length; teeth short and thick, uniserial; yellowish, much mottled and blotched. D. VI-11; A. 11. Scales 30.................... *garmani*

cc. Scales moderate or small, 40 to 90.

l. Soft dorsal and anal short, each of 10 to 14 rays; body more or less elongate.

EUCTENOGOBIUS:

m. Caudal rounded, not much longer than head.

n. Scales 40; dorsal with 9 soft rays only; anal with 9; depth 6.5 in total length; head broad, flattish; snout short, decurved; eye 4.25 in head, 1.33 in interorbital area, longer than snout; maxillary extending to below middle of eye. Some of dorsal spines produced in filaments, the third 1.5 times depth of body; caudal short, rounded. Two rows of ill-defined blotches on upper half of body; 2 rows of brownish spots on second dorsal, upper strongly marked.................... *poeyi*

nn. Scales 50; dorsal and anal with 10 soft rays each; profile very oblique. Color dark-brown.................... *badius*

GOBIONELLUS:

mm. Caudal lanceolate, much longer than head; lower jaw thin; usually a green spot on roof of mouth in life.

o. Body rather deep, depth about 5 in length.

p. Scales rather large, 39 to 42; body moderately elongate, compressed; depth 5.25; head 4. Head not compressed, cheek tumid, snout short, abruptly decurved; mouth large, little oblique, jaws equal, maxillary 2.33 in head, reaching to below pupil; eye 5 in head; teeth above large, unequal, uniserial, some of them fixed, those below small, in a band. Scales anteriorly cycloid, becoming larger posteriorly, and ctenoid; dorsal spines scarcely filamentous, none of them as high as body; caudal 2.25 in body. Light-olive, with dark-olive blotches; body and head with many conspicuous round spots of cream color, each surrounded by a dusky ring, these most distinct on head, all smaller than pupil; snout with dusky streaks; dorsals and caudal sharply barred; anal and ventrals dusky (in male); a small round spot at base of caudal. D. VI-11; A. 11.................... *smaragdus*

pp. Scales comparatively small (53). Body elongate, compressed behind; head a little compressed, 3.75 in length; depth 5; eye 3.5 in head, shorter than rounded snout; maxillary reaching to below middle of eye; teeth small, outer a little enlarged; dorsal spines all shorter than head, not filamentous. Nape scaly, its scales much reduced in size; scales ctenoid. Two violet stripes from eye to mouth; 8 or 9 violet bars on side; 3 or 4 bars on caudal; second dorsal spotted. D. VI-12; A. 11 or 12.................... *strigatus*

oo. Body elongate, depth 6.5 to 9 in length; head 4.5; caudal very long.

q. Scales very small (60 to 90); caudal more than twice as long as head in adult. Body compressed, extremely elongate, depth 6 to 9 in length; head higher than wide, short, compressed, 4.5 to 5 in length; mouth wide, oblique; maxillary in adult reaching to below posterior border of eye. Lower jaw very thin and flat; teeth in both jaws small, subequal, those in upper jaw in a single series, those of lower in a narrow band; outer teeth somewhat movable. Scales anteriorly small, cycloid, embedded, those behind larger and ctenoid; a few scales on upper anterior corner of opercle; dorsal fins high, some spines filamentous, longer than head. Caudal very long, filamentous, 2 to 2.66 in body. Light-olive; fins dusky in male; a round, black spot on side, a little larger than eye, below spinous dorsal; first dorsal spine with 2 or 3 black spots; a small dusky spot at base of caudal; emerald spot on tongue conspicuous, fading in spirits. D. VI-14; A. 14 or 15.

r. Only a few scales on opercle.

s. Scales large, about 60.................... *hastatus*

ss. Scales smaller, about 71.................... *bayamonensis*, 249

rr. Upper part of opercle with a large patch of scales.................... *oceanicus*, 250

247. **Gobius soporator** Cuvier & Valenciennes. *Mapo.*

Head 3 to 3.3; depth 4 to 4.8; eye 4.5 to 5; snout 3.5 to 4; maxillary 2.5 to 3; mandible 2 to 2.3; interorbital 5 to 6; preorbital about 8.5; scales 38,-13; D. VI-10, the longest spine about 1.7 in head, the longest ray 1.8; A. 9, the longest ray 1.8; pectoral 1.3; ventral 1.5. Body stout, heavy forward, compressed posteriorly, the least width of caudal peduncle about 4 in its least depth; head broad, snout blunt; mouth moderate, slightly oblique, the maxillary reaching middle of eye; isthmus very broad, gill-openings extending forward but slightly in front of base of pectoral; lips thick; teeth in upper jaw in a broad band, those of outer series enlarged, the inner ones small; teeth of lower jaw similar but smaller. Entire body covered with large, ctenoid scales, smaller on nape and belly; head naked. Fins rather large; origin of spinous dorsal slightly nearer snout than base of last soft ray; space separating dorsals about 2 in eye; dorsal and anal rays not reaching caudal when depressed; pectoral broad, upper rays partially detached and silk-like; ventral disk rather free from belly, not reaching vent; caudal short, rounded.

Color, mottled or marbled-gray above and on sides and head, under parts white; back with about 4 dark areas extending down on sides; sides with irregular series of small white specks; dorsals and caudal barred with white and dark; anal light, with dark edge; other fins pale. Some specimens are considerably darker and have the fins darker, but the color pattern is essentially the same in all.

Found in the tropical seas; widely distributed and almost everywhere common, lurking among stones or on sand in shallow water, or in rock pools, moving very quickly when disturbed; north on on our coasts to Carolina and Gulf of California. The commonest of all shore-fishes in tropical America. Length 3 to 5 inches. Among our species this seems to be the most nearly related to the European *Gobius niger*, and may, therefore, be held to represent the subgenus *Gobius*, if our other species be placed in different subgenera. Perhaps all the others will ultimately be removed from *Gobius*.

This is apparently the most abundant and generally distributed goby in Porto Rico, the collection containing numerous specimens from San Antonio Bridge, San Geronimo, Palo Seco, San Juan, Mayaguez, Puerto Real, Guanica, Ponce, Fajardo, Hucares, Isabel Segunda, and Culebra Island.

Gobius soporator Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 56, 1837, Martinique; Jordan & Evermann, l. c., 2216, 1898.
Gobius lineatus Jenyns, Zool. Voy. Beagle, 95, pl. 19, fig. 2, 1842, Galapagos Archipelago.
Gobius catulus Girard, Proc. Ac. Nat. Sci. Phila. 1858, 169, St. Joseph Island, Texas.
Gobius mapo Poey, Memorias, II, 277, 1861, Cuba.
Gobius lacertus Poey, Memorias, II, 278, 1861, Cuba.
Gobius andrei, Sauvage, Bull. Soc. Philom., ser. 7, IV, 44, 1880, Rio Guayas, Ecuador.
Gobius carolinensis Gill, Proc. Ac. Nat. Sci. Phila. 1863, 268, Charleston, S. C.
Gobius brunneus Poey, Synopsis, 393, 1868, Havana.
Gobius arundelii Garman, Proc. N. E. Zool. Club, I, June 9, 1899, Clipperton Island.

248. **Gobius lyricus** Girard.

Description of male: Head 4; depth 4.5 to 5; eye 4 to 5; snout 3.6; maxillary 2.3; mandible 2.3; interorbital 4 to 5; preorbital 5 to 6; scales 29,–9; D. vi–11, the longest spine about 3 in head, the longest ray about 1; A. i, 10, the longest ray 1.2; pectoral about equal to head; ventrals 1.1; caudal about twice length of head. Body elongate, tapering; head heavy, body somewhat compressed; head short, broad; snout short, abruptly decurved; mouth rather small, somewhat oblique, maxillary reaching vertical of pupil; lower jaw included; eye small, high; isthmus broad, gill-openings not extending forward under opercles; teeth rather strong, in one series in each jaw; lower jaw with about 4 short canine-like teeth behind the other teeth; teeth of upper jaw larger than those of lower. Fins rather large; first dorsal with 2 or 3 filamentous spines reaching, when depressed, beyond base of second dorsal, or even to caudal; space separating dorsals very short, distance from snout to origin of first dorsal 3 in body; anal rays reaching caudal; caudal long and pointed; pectoral rather long, reaching origin of anal; ventrals rather short, disk not reaching vent. Scales large, cycloid, somewhat crowded anteriorly; nape scaled, head and breast naked.

Color, olivaceous or dark, with 6 or 7 somewhat regular dark crossbars, the 2 or 3 posterior ones broadest, body with other dark blotchings and irregular markings; head marbled with darker, jaws, opercles, and branchiostegals black; a black bar across isthmus; first dorsal mostly dusky translucent, somewhat barred; second dorsal and anal plain dusky; caudal dark-blue with 2 longitudinal stripes of bright red changing to rose or orange in alcohol; pectoral finely barred with blackish and pale; lower parts yellowish.

Female examples may be described as follows: Head 3.8; depth 4.9; eye 3.6 to 4; snout 4 to 4.5; maxillary 2.5; mandible about 3; interorbital 5; preorbital 5; scales 29–9. D. vi–11, the longest ray about 1.5 in head; A. i, 10, longest ray 1.7; pectoral 1; ventral 1.3; caudal 0.8. Form not markedly differing from that of male, caudal peduncle less slender. Color darker, head and body blotched with dark; about 4 large dark blotches across back, more distinct than in male; black blotch at base of caudal large; fins all barred with light and dark; no reddish bands on caudal; dorsal spines less filamentous.

Found in the Gulf of Mexico and along the South Atlantic coast from Galveston and Indian River, south through the West Indies; generally common, but probably not in Porto Rico. Length 2 to 3 inches. The collection contains 5 males and 4 females from Fajardo and 2 males from Isabel Segunda.

Gobius lyricus Girard, Proc. Ac. Nat. Sci. Phila. 1858, 169, Brazos Santiago, Texas; Jordan & Evermann, l. c., 2224, 1898.
Gobius wurdemanni Girard, Proc. Ac. Nat. Sci. Phila. 1858, 169, Brazos Santiago, Texas.
Smaragdus costalesi Poey, Memorias, II, 280, 1861, Havana.

249. **Gobius bayamonensis** Evermann & Marsh.

Head 5.8; depth 6.4; eye 5; snout 3.2; maxillary 1.8; mandible 1.9; interorbital 7.6; preorbital 4.6; scales 74,-19, about 29 before dorsal; D. VI-14, longest spine about 0.7 in head, the longest ray 1.5; A. 15, longest ray 1.5; pectoral 0.9; ventrals 1; caudal very long and pointed. Body very long and slender; head long; caudal peduncle long; mouth very large, oblique; maxillary long, reaching past posterior border of orbit; only a few scales on opercle.

Color as in *G. oceanicus*, which this species closely resembles. The smaller (74 instead of 63 to 65), almost cycloid scales, fewer scales on opercle, longer head, larger mouth, longer maxillary, and longer and more slender body are differences which we can not reconcile with the descriptions of *G. oceanicus* or with numerous specimens of it which we have from Porto Rico.

This description is based on a single specimen 9 inches in length, No. 49365, U. S. N. M., bought in the San Juan market, January 14. It probably came from near the mouth of Bayamon River at Palo Seco, for which stream the species was named.

Gobius bayamonensis Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 355, San Juan market, Porto Rico.

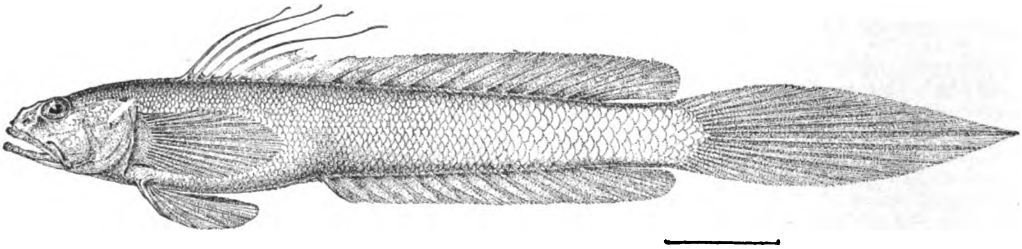

FIG. 90.—*Gobius bayamonensis.*

250. **Gobius oceanicus** Pallas. *Esmeralda; "Seti."*

Head 5; depth 6 to 6.5; eye 5 to 5.5; snout about 3; maxillary 2 to 2.3; mandible 2; interorbital 7 to 8; preorbital 4 to 4.5; scales about 63,-17; D. VI-14, the longest spine variable in length, 0.7 to 1.5 in head. the longest ray about 1.5; A. 15, the longest ray 1.4 to 2 in head; pectoral 1.1; ventrals 1.2; caudal long and pointed. Body very elongate, tapering gradually to long caudal peduncle; head short; snout short; mouth large, oblique, lower jaw slightly projecting, maxillary reaching posterior border of pupil; interorbital very narrow, preorbital broad; isthmus broad, gill-openings not extending forward much beyond angle of opercle; teeth in narrow bands on jaws, outer slightly enlarged. Scales ctenoid, rather large, smaller and crowded anteriorly, about 26 before dorsal; nape scaled, breast and cheek naked, opercle with a few scales at top.

Color in alcohol: Pale-olivaceous; head, back, and upper part of side with fine dark punctulations; a large black blotch on side below spinous dorsal; middle of side with about 12 broad <-shaped black markings opening backward; an obscure dark blotch at base of caudal; opercle with a dark blotch; 3 or 4 small black spots on first dorsal spine; spinous dorsal dusky with a light and a dusky streak at base; soft dorsal dusky, with a light area between each two rays, anterior rays barred with light and dark; anal pale; pectoral somewhat dusky; ventrals dark, probably blue in life, with white border.

Found along the South Atlantic and Gulf coasts of the United States and southward through the West Indies to the South American coast; not rare; recorded from Cuba, Martinique, Surinam, and Cayenne. Apparently common in Porto Rico, as shown by the numerous specimens in the collection from San Juan market, Palo Seco, and Boqueron. Specimens were dredged at stations 6054, off San Juan Harbor, in 4 to 5 fathoms, and 6087, off Culebra Island, in 15 fathoms. Our largest examples are about 7.5 inches long. This species reaches a foot or more in length and is of considerable value as food.

Gobius cauda longissima acuminata Gronow, Zoophyl., 82, No. 227, pl. 4, fig. 4, 1763, locality unknown.
Gobius oceanicus Pallas, Spicilegia, VIII, 4, 1769, after Gronow; Jordan & Evermann, l. c., 2230, 1898.
Gobius lanceolatus Bloch, Fische Deutschlands, II, 8, pl. 38, fig. 1, 1783, Martinique.
Gobius bacalaus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 119, 1837, Surinam, Cayenne, and Cuba.
Gobionellus lanceolatus, Poey, Fauna Puerto-Riqueña, 338, 1881; Stahl, l. c., 78 and 165, 1883.

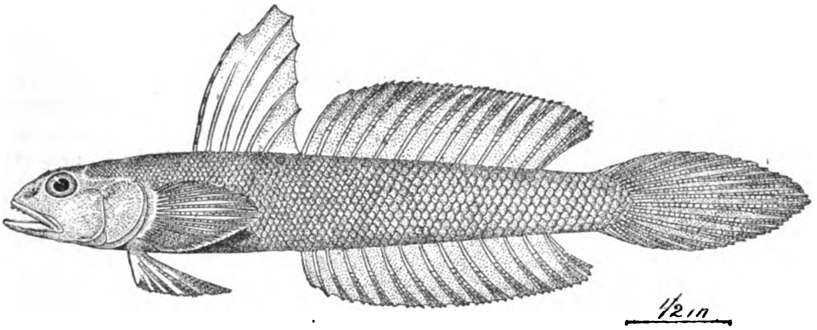

FIG. 91.—*Gobius oceanicus*.

Genus 139. AWAOUS Steindachner.

Inner edge of shoulder-girdle with two or more conspicuous dermal flaps; preorbital region very long; premaxillary and maxillary strong; lips thick; scales rather small, ctenoid, 40 to 80 in a longitudinal series; interorbital groove with a conspicuous median crest; otherwise essentially as in *Gobius*. The species reach a large size and are confined to the fresh waters of the tropics of America and to the Hawaiian Islands. Asiatic species of similar habit have much larger scales and seem to form a distinct genus, *Rhinogobius* Gill. The physiognomy in each is peculiar, the snout being long and convex.

a. Scales about 53, little crowded anteriorly, 21 before dorsal on nape; depth 5.66 in length; head 4; eyes placed high, interorbital area equal to diameter of eye; mouth horizontal; maxillary extending to middle of eye, 2.33 in head, lower jaw more flat than in *A. taiasica*; teeth small, in narrow bands, those of outer row above enlarged, some large teeth in band of lower jaw. D. VI–I, 12; A. I, 10. Uniform yellowish in spirits................ *flavus*

aa. Scales 60 to 70, crowded anteriorly, about 30 scales before dorsal on nape; 21 scales between second dorsal and anal; head broader than high; body compressed posteriorly, rather depressed anteriorly; greatest depth 5.25 in length; head 3.25 in length. Olivaceous; a series of irregular, roundish blotches along middle of side; narrow dark streaks radiating from eye; a blackish streak running across upper margin of opercle and extending obliquely across base of upper pectoral rays; belly white; dorsal and caudal more or less distinctly barred with wavy blackish lines. D. VI–11; A. 11; scales about 65.. *taiasica*, 251

aaa. Scales 76 to 82, 24 scales between second dorsal and anal; head as broad as high; depth of body 6.6 in length; head 4, flat above, snout elongate, upper profile oblique; eye one-eighth of head, equaling interorbital area (in adult); mouth horizontal; lower jaw included; maxillary reaching to below anterior margin of eye; teeth of outer series enlarged; canine teeth none; scales ctenoid, those on nape and anterior part of body very small; head naked; dorsal fins lower than body, none of the spines produced; caudal rounded, 7 in length of body. Yellowish olive; back and sides reticulated with blackish; head, dorsal, caudal, and pectoral fins dotted with blackish, the spots forming streaks on second dorsal; six cross-series of dots on caudal; an irregular small blackish spot on upper part of root of pectoral. D. VI–11; A. 11; scales about 80...................... *mexicanus*

251. Awaous taiasica (Lichtenstein). "*Guavina*"; "*Saga*" *or* "*Zaga*."

Head 3.5; depth 5.4 to 6; eye 5.5 to 6; snout 2.2 to 2.4; maxillary 2.4 to 2.9; mandible 2.4 to 3; interorbital 6.5 to 8; preorbital 3.3 to 4; scales 66 to 71,–22; D. VI–11, longest spine about 2 in head, longest ray 2; A. I, 10, longest ray 2 to 3 in head; pectoral 1.6; ventral 1.7; caudal 1.5. Body rather slender, head heavy, somewhat depressed, tapering, its greatest width about 1.5 in its length; snout long; mouth moderate, very broad, its width about 2.5 in head; maxillary reaching anterior border of orbit; lips very heavy, upper with a broad flap; teeth of upper jaw in two series, those of anterior series much enlarged and recurved; teeth of lower jaw in a narrow band, outer scarcely enlarged; no teeth on vomer or palatines; isthmus very broad, gill-openings scarcely extending forward; branchiostegals 4; gillrakers 3 + 6, very short and soft; inner edge of shoulder-girdle with 2 or 3 short papillæ. Posterior half of body compressed, least width of caudal peduncle about half its least height. Scales small, ctenoid, much reduced anteriorly, those on nape and in front of dorsal embedded and cycloid, about 30 series between dorsal and occiput; head naked; breast scaled. Fins rather large; origin of spinous dorsal about midway between tip of snout and middle of soft dorsal; space between dorsals scarcely half orbit; dorsal and anal rays, when depressed, not reaching base of caudal; pectoral long, nearly reaching vent; ventral disk broad and free; caudal rounded.

Color, pale-olivaceous or yellowish, with a series of about 8 large black blotches along middle of side; back and head blotched and vermiculated with dark; under parts pale; dorsals and caudal with alternate bars of light and dark; pectoral dusky; ventrals and anal pale.

This goby reaches a length of a foot or more. It is extremely variable in form and coloration, as is the case with most widely distributed fresh-water fishes. It is found in the fresh waters of the West Indies and on both coasts of Mexico, south to Brazil; common in Cuba, in Sinaloa, and about La Paz in Lower California, thence southward to Panama. It is also common in the fresh and brackish waters of Porto Rico, specimens being obtained from the Bayamon River near Bayamon, the Rio de Caguitas at Caguas, and from a brackish pool on Vieques Island just west of the town of Isabel Segunda. It is of some value as food.

Amore guacu, Marcgrave, Hist. Brasil., 166, 1648, Brazil.
Gobius taiasica Lichtenstein, Berl. Abhandl., 273, 1822, Brazil; not *Taiasica* of Marcgrave.
Gobius banana Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 103, 1837, Santo Domingo.
Gobius martinicus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 105, 1837, Martinique.
Chonophorus bucculentus Poey, Memorias, II, 275, 1861, Cuba.
Rhinogobius contractus Poey, Mem., II, 424, 1861, Cuba; Poey, Fauna Puerto-Riq., 338, 1881; Stahl, l. c., 78 and 165, 1883.
Gobius dolichocephalus Cope, Trans. Amer. Philos. Soc. Phila. 1869, 403, near Orizaba, Mexico.
Euctenogobius latus O'Shaughnessy, Ann. Mag. Nat. Hist., series 4, XV, 1875, 146, Bahia.
Awaous taiasica, Jordan & Evermann, l. c., 2236, 1898.

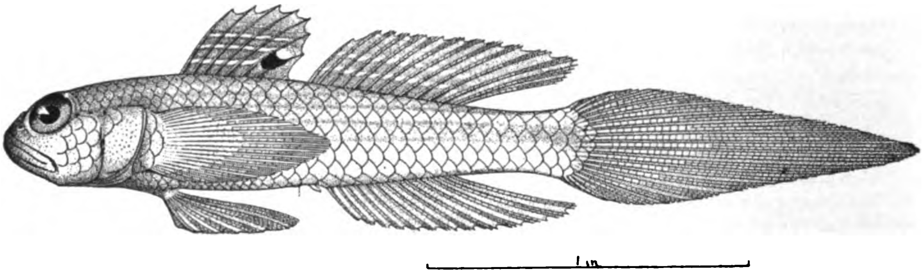

FIG. 92.—*Bollmannia boqueronensis*.

Genus 140. BOLLMANNIA Jordan.

This genus differs from *Lepidogobius* in having no fleshy processes on inner edge of shoulder-girdle, the interorbital area of skull narrower and without trace of median keel, and in the very large ctenoid scales. From *Gobius* proper it is distinguished by the presence of 7 dorsal spines and by the presence of large scales on cheek. The genus *Bollmannia* has now five known species, *B. chlamydes*, *B. ocellata*, *B. macropoma*, *B. stigmatura*, and *B. boqueronensis*. The first of these was described in 1889 by Dr. Jordan from the west coast of Columbia and the next three by Dr. Gilbert in 1891 from the Gulf of California. Not until the last species was obtained by us off Porto Rico was the genus known to have any representative in the Atlantic. All the species are found only at considerable depths, and do not inhabit shoal water, as is the case with most other gobies.

252. Bollmannia boqueronensis Evermann & Marsh.

Head 4; depth 5.5; eye 3.5; snout 4.4; maxillary 2.2; mandible 2.5; interorbital width 3 in eye; preorbital 6; scales 27,–8; D. VII–13, the longest spine 1.5 in head, the longest ray 1.2; A. 12, the longest ray 1.25 in head; pectoral 0.75; ventrals 1.1; caudal 0.4. Body long, slender, tapering; head short; snout blunt; mouth large, oblique; jaws subequal, maxillary reaching posterior border of pupil; isthmus narrow, gill-openings reaching forward to below preopercle; eyes large, high, close together, interorbital very narrow and without median keel; no fleshy process on inner edge of shoulder-girdle; teeth on jaws in narrow bands, those of outer series somewhat enlarged; opercle short, about 3 in head. Fins moderate; origin of spinous dorsal slightly behind base of pectoral, its spines 7 in number, not filamentous; interspace between dorsals less than diameter of eye; soft rays of dorsal and anal reaching, when depressed, beyond base of caudal; caudal long and pointed, as in *Gobius oceanicus;* pectoral pointed, reaching beyond origin of anal; ventral disk moderate, free from belly, longest rays barely reaching origin of anal. Scales very large, weakly ctenoid; nape, cheeks, and breast scaled, scales somewhat smaller than on body, about 9 scales before dorsal.

Color, pale-olivaceous or straw-color, back and upper part of head with profuse fine dark punctulations; under parts pale, breast somewhat dusky; dorsal fins barred with white and dark, a large jet-black ocellus on posterior part of spinous dorsal; other fins pale, ventral disk somewhat dusky in front.

Known only from the type and four cotypes dredged by the *Fish Hawk* at station 6074, off Puerto Real, in 8.5 fathoms, January 25, 1899. It reaches a length of 2.75 inches. Type No. 49366, U. S. N. M.

Named from Ensenada del Boqueron, in which the type was obtained.

Bollmannia boqueronensis Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 356, Ensenada del Boqueron, Porto Rico.

Genus 141. MICROGOBIUS Poey.

Dorsal spines 7 or 8; scales very small, cycloid or weakly ctenoid, body scaled anteriorly as well as posteriorly, head naked, nape, belly and breast usually so. Inner edge of shoulder-girdle without fleshy processes; body more or less compressed; mouth large, very oblique; lower jaw conspicuous, teeth strong; interorbital groove with or without a median ridge. Vertebræ 11 + 15 or 16.

a. Scales about 42. Body elongate, moderately compressed, depth 4 to 5 in length; head long and large, rather sharp in profile, 3 to 3.5 in body; eye longer than snout, 4 in head; mouth large, very oblique, lower jaw strongly projecting; maxillary 1.5 to 2.5 in head, extending to opposite middle of eye, or much beyond front of orbit; teeth in few series, the outer very long and slender, curved, the lower longest, none canine-like; scales small, some of them with short, thick teeth, those of anterior part of body not well developed; dorsal spines more or less filamentous, third and fourth or fourth and fifth sometimes with long filaments; caudal pointed, about as long as head. Grayish-olive, with rather sharply defined markings of darker brown overlaid with orange in life; head with a pale-bluish or gilt stripe from maxillary backward across suborbital region to upper edge of gill-opening; another pale gilt streak from snout along lower part of eye, another from angle of mouth upward and backward; rest of head dark; opercle with an oblique, blackish bar; top of head and nape with dark marbling surrounded by paler reticulations; back with a series of black cross-blotches mostly separated on median line; 2 narrower dark vertical bars behind pectoral; middle line of side posteriorly with longitudinally oblong black blotches; besides these, numerous other blotches not regularly arranged; first dorsal with 2 or 3 oblique black bands; second dorsal pale, with about 4 series of black dots; caudal spotted with black; pectoral yellowish; ventral black, its center yellowish (male); anal pale. D. VII-15; A. 16 or 17.................. *gulosus*

aa. Scales 50 to 55.

b. Scales 50,-14, cycloid; D. VII-15; body scarcely compressed.............................. *eulepis*

bb. Scales 55,-12, strongly ctenoid; D. VII-17; body greatly compressed.............................. *meeki*, 253

aaa. Scales 65 or more.

c. Caudal fin more than one-third (two-fifths) length of body. Scales very small, cycloid, deciduous. Body elongate, much compressed, highest in front of ventrals, tapering regularly to very narrow, short caudal peduncle; greatest depth 4.75 in length; head 3.5. Head compressed, much higher than wide; snout very short, acute, preorbital not as wide as pupil; mouth terminal, very wide and oblique; jaws equal; maxillary reaching vertical from middle of orbit, 2 in head. Outer series of teeth enlarged. Eye 3 in head. Dorsals closely contiguous; spines very slender, fifth slightly produced and filamentous; pectoral as long as head. Head and body translucent, overlaid by brilliant green luster, formed by minute, close-set green points; 3 conspicuous translucent bars wider than interspaces, crossing body close behind head; head with 2 brilliant narrow blue and green lines running obliquely across cheek below eye; dorsal whitish, with 2 or 3 lengthwise series of large reddish-brown spots; spinous dorsal blackish at base, upper caudal rays marked with red, lower portion of caudal and most of anal fin blackish, anal whitish at base, anterior rays tipped with white. In spirits, body dusted with dark points; 2 light crossbars toward head; lower part of caudal and anal black. D. VII-16; A. 15.. *thalassinus*

cc. Caudal fin less than one-third length of body. Scales small, cycloid, embedded. Body very much compressed, more or less elongate, greatest depth at ventrals 4 (female) to 6.5 (male) in length; head 3.5 to 4. Head much compressed, much deeper than wide. Snout very short, acute, anterior profile not decurved, not steep; preorbital not as wide as pupil; mouth very large, very oblique or almost vertical; maxillary extending to below pupil, 2 in head (in male), 2.25 (in female). Lower jaw projecting, teeth of outer series enlarged, recurved. Eye 3.25 to 4 in head. Dorsals contiguous, spines very fine, produced in filaments, third highest, a little longer than head; second dorsal and anal high. Head and nape naked. In the female the depth is greater, mouth less oblique, smaller; profile from spinous dorsal oblique. First dorsal spine highest, 3.33 in length. Ventrals much shorter than in males. Dark gray; female with a short bright-blue bar bordered by blackish above pectoral; a blotch of sky-blue and orange below eye; fins dusky, ventrals pale in female, dusky in males. Males with body plain bluish-gray. D. VII-17 to 20; A. 18 to 21; scales 68 to 70 .... *signatus*

253. **Microgobius meeki** Evermann & Marsh.

Head 3.75; depth 6; eye 3.5; snout 5.5; interorbital 7; preorbital 7; maxillary 2; mandible 1.5; scales 55,-12; D. VII-17; A. 16. Body slender, greatly compressed, tapering regularly from pectorals to caudal; head moderately heavy, interorbital space very narrow; eye large, high; mouth large, oblique; maxillary reaching posterior border of orbit; lower jaw projecting; teeth in bands in each jaw, outer series greatly enlarged and strongly recurved, those of lower jaw largest; isthmus rather narrow, gill-openings continuing forward; body densely scaled, scales strongly ctenoid, those anteriorly somewhat reduced; nape, breast, and entire head naked; origin of spinous dorsal from snout 3.5 in length; dorsals very close together; spines of first dorsal filamentous, exceeding head in length; soft dorsal and anal long, their bases about equal, about 2.5 in body, their last rays reaching past base of caudal when depressed; caudal pointed, its longest rays about equal to head; pectoral about equal to head, reaching origin of anal; ventrals united, almost reaching origin of anal.

Color, light-olivaceous, dusted over uniformly with fine dark punctulations; large dark shoulder-spot between base of pectoral and origin of spinous dorsal; a few indistinct dark areas on side of head; lower jaw dark at tip; an obscure dark blotch at base of caudal; fins all rather pale except ventrals, which are dark, perhaps bluish in life; caudal somewhat dusky; anal dark-edged.

This species seems related to *M. eulepis* Eigenmann & Eigenmann, described from Fortress Monroe, Va., but differs in the smaller and strongly ctenoid scales, greatly compressed body, and in coloration. It is described from a single specimen, 1.5 inches in length (No. 49367, U. S. N. M.), collected at Fish Hawk station 6087, in 15.25 fathoms, between Culebra and Vieques islands.

Microgobius meeki Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 356, between Vieques and Culebra islands, east of Porto Rico.

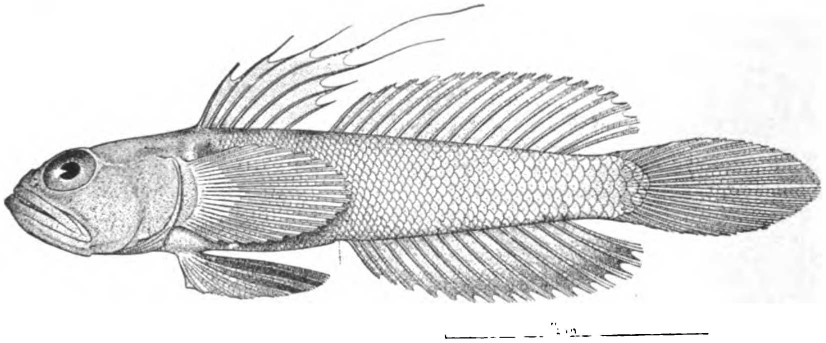

FIG. 93.—*Microgobius meeki.*

Genus 142. GOBIOIDES Lacépède. Barretos.

Body greatly elongate, compressed behind, scales very minute; head small; eyes very small; mouth large, oblique, lower jaw projecting; gill-openings moderate. Teeth in a band, those in outer series being very strong. Dorsal rays V to VII, 16 to 23; anal rays 17 to 23. Dorsal fin low, continuous, spines similar to soft rays, but more widely separated; soft dorsal and anal joined to base of caudal; ventrals 45, united in a disk which is formed much as in *Gobius*. No air-bladder; no pseudobranchiæ. From *Tænioides* (=*Amblyopus*) the genus *Gobioides* is distinguished by the absence of barbels, the presence of scales, and by the much smaller number of rays in its vertical fins.

Found in the brackish waters of the Tropics, reaching a considerable size.

254. **Gobioides broussonnetii** Lacépède. *Barreto.*

Head 5.25 (young) to 7 (adult); caudal 3.5 to 5; eye small but evident, 7 to 10 in head; interorbital space 1 to 1.66 diameter of eye; D. VII, 16; A. I, 16. Body elongate, mouth oblique, maxillary extending beyond eye; teeth in bands, outer series enlarged, shorter, and closer set than in *Gobioides peruanus;* scales twice as large as in *G. peruanus*, those on anterior part of body not imbricated, much smaller than those on posterior part, which are elongate-oval in form. Violet bars extending downward and forward on upper part of body; sometimes a violet spot with a lighter or darker dot at end of bars; head marbled or spotted with dark violet or brown. (Steindachner.)

West Indies to Brazil; common southward, ascending rivers; once taken near New Orleans (Bean & Bean). Not seen by us in Porto Rico, but recorded from that island by Professor Poey. Length 20 inches or more.

Gobioides broussonnetii Lacépède, Hist. Nat. Poiss., II, 580, 1798, probably from Surinam, "given by Holland to France"; Jordan & Evermann, l. c., 2263, 1898.
Amblyopus brasiliensis Bloch & Schneider, Syst. Ichth., 69, 1801, Brazil; on drawing made by Prince Maurice.
Gobius oblongus Bloch & Schneider, Syst. Ichth., 548, 1801; based on Lacépède.
Gobioides barreto Poey, Memorias, II, 282, 1861, Cuba; Poey, Fauna Puerto-Riqueña, 338, 1881.
Amblyopus mexicanus O'Shaughnessy, Ann. Mag. Nat. Hist., series IV, vol. XV, 1875, 147, Mexico.

Family LXVII. ECHENEIDIDÆ. The Remoras.

Body fusiform, elongate, covered with minute, cycloid scales. Mouth wide, with villiform teeth on jaws, vomer, palatines, and usually on tongue. Premaxillaries not protractile. Lower jaw projecting beyond upper. Spinous dorsal modified into a sucking disk, which is placed on top of head and neck and is composed of a double series of transverse, movable, cartilaginous plates, serrated on their posterior or free edges. By means of this disk these fishes attach themselves to other fishes or to floating objects and are carried for great distances in the sea. Opercles unarmed. Pectoral fins placed high; ventral fins present, thoracic and close together, I, 5; dorsal and anal fins long, without spines, opposite each other; caudal fin emarginate or rounded. Branchiostegals 7. Gills 4, slit behind fourth; gillrakers short; gill-membranes not united, free from isthmus. Pseudobranchiæ obsolete. Several pyloric appendages. No air-bladder. No finlets. No caudal keel. Vertebræ more than 10 + 14.

This family embraces about 4 genera and 10 species, found in all seas, all having a very wide range. The species of this group are apparently descended from a fossil genus, *Opisthomyzon*.

a. Body very slender, vertebræ 14 + 16 = 30; ventrals narrowly adnate to abdomen; lower jaw produced in a flap; pectoral acute, with flexible rays.
b. Laminæ 10 only .... PHTHEIRICHTHYS
bb. Laminæ 20 to 28 .... ECHENEIS, 143
aa. Body rather robust, vertebræ 12 + 15 = 27; ventrals broadly adnate to abdomen; lower jaw not produced; pectorals rounded.
c. Laminæ 24 to 27 .... REMILEGIA
cc. Laminæ 16 to 20.
d. Pectoral rays soft and flexible .... REMORA
dd. Pectoral rays stiff and ossified .... RHOMBOCHIRUS

Genus 143. ECHENEIS (Artedi) Linnæus.

Body comparatively elongate, vertebræ 14 + 16 = 30; disk long, of 20 to 28 laminæ; pectoral pointed, its rays soft and flexible; soft dorsal and anal long, of 30 to 41 rays each; caudal lunate in adult, convex in young.

Species of wide distribution, attaching themselves mainly to sea turtles and large fishes.

a. Disk of 22 to 26 laminæ (rarely 21 or 28), its length less than one-fourth body .... *naucrates*, 255
aa. Disk of 20 or 21 laminæ, its length more than one-fourth body .... *naucrateoides*

255. Echeneis naucrates Linnæus. *Shark-sucker; Pega; Pegador; Sucking-fish.*

Head 5.25; depth 11 to 12; D. XXII to XXVIII (rarely XXI), 32 to 41; A. 31 to 38. Breadth between pectorals 7.5; disk 4 to 5 in body; eye 5 in head; snout 2.33; maxillary 3; from angle of mouth to tip of lower jaw 2.66; pectoral 1.4; ventrals 1.5; middle caudal rays 1.4; highest anal ray 2; highest dorsal ray 2.33; width of disk 2.5 in its length; base of dorsal 2.5, anal 2.5, in body. Body elongate, subterete, slender; lower jaw strongly projecting, the tip flexible; maxillary reaching nostril; teeth uniform in adult, young with series of small slender teeth in advance of others; gillrakers short and slender, about equal to pupil; vertical fins low; anal rays higher than dorsal anteriorly; pectoral reaching very slightly past tips of ventrals; origin of ventral spine under middle of pectoral base; inner rays of ventral fins narrowly adnate to abdomen; dorsal and anal commencing and ending opposite each other; caudal with middle rays produced in young, the fin becoming emarginate or lunate with age.

Color, brownish; belly dark, like back, as usual in this family; side with a broad stripe of darker, edged with whitish, extending through eye to snout; caudal black, its outer angles whitish; pectoral and ventrals black, sometimes bordered with pale; dorsal and anal broadly edged with white anteriorly; adult nearly uniform dark-brown, not paler below.

Widely distributed in the warm seas; common north to Cape Cod and occasionally to San Francisco, attaching itself to turtles and to large fishes. Very common in the Tropics, being found attached to sharks, groupers, or any other large fish, without regard to species. Few large sharks at Key West are without them. They are often caught with hook and line from the wharf, where they frequently forsake their host to take the bait. Lütken's remark that only *Remora remora* has been recorded from sharks is no longer true. Several writers have recognized 2 species of *Echeneis* proper—*naucrates*, with 22 to 26 laminæ, the disk 4 to 5 in body, and *naucrateoides* (=*albicauda*=*holbrooki*=*lineatus*), in which the disk is longer, 3.6 to 4 in body, but composed of fewer, 20 or 21, laminæ. The latter form is rather common on our coast, the specimens from Key West above mentioned having 21.

Not obtained by us in Porto Rico, but recorded from that island by Professor Poey and Dr. Stahl.

Echeneis neucrates (misprint for *naucrates*) Linnaeus, Syst. Nat., ed. X, 261, 1758, "in Pelago Indico."
Echeneis albicauda Mitchill, Amer. Monthly Mag., II, 1817, 244, New York.
Echeneis lunata Bancroft, Proc. Comm. Zool. Soc., I, 134.
Echeneis australis Griffith, Cuvier Anim. Kingdom, 504, 1837.
? Echeneis vittata Lowe, Proc. Zool. Soc. Lond. 1839, 89, Madeira.
Leptecheneis naucrates, Poey, Fauna Puerto-Riqueña, 333, 1881; Stahl, l. c., 80 and 166, 1883.
Echeneis naucrates, Jordan & Evermann, l. c., 2269, 1898.

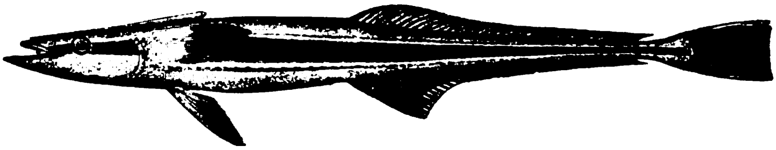

FIG. 94.—*Echeneis naucrates.*

Family LXVIII. MALACANTHIDÆ. The Blanquillos.

Body more or less elongate, fusiform or compressed. Head subconical, anterior profile usually convex; suborbital without bony stay; bones not greatly developed; cranial bones not cavernous; opercular bones mostly unarmed. Mouth rather terminal, little oblique; teeth rather strong; no teeth on vomer or palatines; premaxillary usually with a blunt posterior canine, somewhat as in the *Labridæ;* premaxillaries protractile; maxillary without supplemental bone, not slipping under edge of preorbital. Gills 4, a long slit behind fourth; pseudobranchiæ well developed; gill-membranes separate, or more or less united, often adherent to isthmus; lower pharyngeals separate. Scales small, ctenoid; lateral line present, complete, more or less concurrent with back; dorsal fin long and low, usually continuous, spinous portion always much less developed than soft portion, but never obsolete; anal fin very long, its spines feeble and few; caudal fin forked; tail diphycercal; ventrals thoracic or subjugular, I, 5, close together; pectoral fin not very broad, rays all branched; vertebræ in normal or slightly increased number (24 to 30). Pyloric cæca few or none.

Fishes of temperate and tropical seas, some of them reaching a large size. Genera about 6; species about 8 to 10, mostly American. The relationships of the family are obscure, and it may be that the genera here associated are not really closely allied.

MALACANTHINÆ:
- *a.* Vertebræ 24; peropercle entire.
  - *b.* Soft dorsal and anal extremely long, each with more than 40 rays; form slender; scales very small.. MALACANTHUS
- *aa.* Vertebræ more than 24; preopercle more or less serrate.

CAULOLATILINÆ:
- *c.* Soft dorsal and anal moderate, each with 22 to 27 soft rays; preopercle serrate; scales rather small; form robust.
  - *d.* Upper jaw with posterior canines; dorsal spines graduated.. CAULOLATILUS, 144

LATILINÆ:
- *cc.* Soft dorsal and anal short, each of 13 to 15 soft rays; preopercle denticulate; scales small; form robust.
  - *e.* Nape with a large adipose appendage; a fleshy prolongation on each side of labial fold, extending forward behind angle of mouth.. LOPHOLATILUS

Genus 144. CAULOLATILUS Gill. Blanquillos.

Body elongate, subfusiform, not strongly compressed, heavy forward, tapering to a rather slender caudal peduncle; profile of head strongly arched; mouth moderate, little oblique, jaws nearly equal; lips thick; maxillary narrow, not slipping under preorbital; teeth in villiform bands, preceded by a row of stronger acute teeth; posterior teeth in each jaw canine-like, directed forward; posterior canines of upper jaw largest; no teeth on vomer or palatines; preopercle pectinate, teeth nearly even; opercle with a blunt, flat spine; eyes large, lateral; gill-membranes slightly connected, forming a fold across isthmus, with which they are narrowly joined; branchiostegals 6; gillrakers short and stout; nostrils double, round, close together; scales small, firm, ctenoid; lateral line continuous, concurrent with the back; dorsal with 7 to 9 slender, pointed, graduated spines and 22 to 27 soft rays; anal similar to soft dorsal, with 1 or 2 small spines and more than 20 soft rays; caudal fin forked; ventral fins thoracic; no adipose appendage at nape; vertebræ $12 + 15 = 27$.

Large fishes of the warm seas of America; valued as food.

a. Scales small, about 125 in lateral line, about 50 in a transverse series.
b. Eye small, 6 in head; depth 3.5 in body; scales 13–120–35 .... *microps*
aa. Scales larger, about 10–106–25 .... *cyanops*, 256

256. Caulolatilus cyanops Poey. *Blanquillo; Tremba.*

Head 4 in total length; D. VII, 24; A. I, 22 (scales 10–108–25. Bean). Profile convex before eye, not ascending to nape; no scales on fins; soft rays little divided; caudal slightly lunate; the first caudal vertebra spoon-like, its cavity receiving air-bladder; vertebræ $12 + 15$; no pyloric cæca; stomach short; air-bladder large.

Color greenish above, a faint, broad, interrupted brown band above lateral line; some small brown spots above and below it; region below eye clear blue, not very different from color of belly; soft dorsal brown, paler at its base, edged with orange; spinous dorsal orange. (Poey.)

The blanquillo is related to the tile-fish, and is known only from the coasts of Cuba and Porto Rico, though it may be identical with *C. chrysops*, described from the coast of Brazil. It was not obtained by us in Porto Rico, but has been recorded from that island by Poey and Stahl.

When at Nassau, en route to Porto Rico, we caught with hook and line 2 fine examples of *Malacanthus plumieri* (Bloch), another relative of the tile-fish. This species is called "sand-fish" at Nassau, and its occurrence about Porto Rico may be confidently expected.

Caulolatilus cyanops Poey, Repertorio, I, 312, 1867, Cuba; Poey, Fauna Puerto-Riqueña, 334, 1881; Stahl, l. c., 78 and 164, 1883; Jordan & Evermann, l. c., 2278, 1898.

Family LXIX. DACTYLOSCOPIDÆ. The Sand Star-gazers.

Body oblong, low, compressed posteriorly, covered with moderate, cycloid, imbricated scales; lateral line complete, anteriorly running alongside of back, posteriorly median; head oblong, nearly plane above; eyes small, superior, well forward; suborbital bones enlarged, but without bony stay connecting with preopercle; nostrils double; opercles fringed; mouth nearly vertical; premaxillaries protractile, not forming entire edge of upper jaw; lips fringed as in *Uranoscopidæ;* gill-openings very broad, membranes separated and free from isthmus, pseudobranchiæ present or obsolete. Dorsal fin very long, continuous or divided, several of anterior rays spinous; anal very long, commencing close behind vent, which is near breast; caudal diphycercal, free from dorsal and anal; pectoral variable, base broad and procurrent; ventrals jugular, I, 3; vertebræ more than $10 + 14$; pyloric cæca none.

Small fishes living on sandy shores of tropical America, comprising 4 genera and about 10 species. The family is nearly related to the *Uranoscopidæ*, of which group it seems to be a reduced or degenerate branch. Its relation with the Asiatic family *Leptoscopidæ* are most intimate, the incomplete ventrals and simple pectoral rays of *Dactyloscopidæ* being the chief distinctive features.

Genus 145. DACTYLOSCOPUS Gill.

Body moderately elongate, covered with rather large, cycloid scales; head cuboid, oblong, and nearly flat above; eyes small; interorbital space broad; mouth nearly vertical; lower jaw not dilated beneath nor emarginate in front, without barbels; no intralabial filament; teeth villiform, on jaws only; pseudobranchiæ very small or obsolete. Dorsal commencing at nape, with 6 to 12 slender spines, soft rays numerous; anal inserted behind dorsal; ventral rays, i, 3.

a. Dorsal rays x to xii, 22 to 31; anal rays fewer than 35.
b. Soft dorsal with 28 to 31 soft rays; anal with 32 or 33; scales about 45.
c. Body rather slender, depth about 6 in length (7 with caudal); opercular fringe of 15 filaments ..... *tridigitatus*, 257
cc. Body rather stout, depth 5.25 in length (6 in total with caudal); opercular fringe of 18 filaments.
d. Back not barred; head blotched and dotted .... *poeyi*

257. Dactyloscopus tridigitatus Gill.

Head 5 (in total) with caudal; depth 7; D. xii, 28; A. ii, 32; P. 13; V. i, 3; scales 11 + 4 + 30 = 45. Body slender, much compressed posteriorly; opercular fringe of 15 separate filaments. Origin of dorsal fin over lower angle of base of pectorals, or immediately before margin of operculum, its distance from snout to dorsal 5 in total length of body. Pseudobranchiæ very small (overlooked by Dr. Gill, but evident in living specimens).

In life, pale sand-color above, lower part whitish; above 12 narrow crossbands of whitish on the back, not extending down far on the side; head mottled above; fins all pale.

This species of star-gazer is found in the West Indies and the Barbados and north to southern Florida. It has been taken at Key West and Cape Florida, and a single example, 3 inches long, was seined by us in Ensenada del Boqueron, Porto Rico. It does not reach a length of more than a few inches, and is a shallow-water fish, frequenting the coral sands near shore, in which it is wont to bury itself, leaving only its eyes and mouth exposed, after the fashion of the flounders.

Dactyloscopus tridigitatus Gill, Proc. Ac. Nat. Sci. Phila. 1859, 132, Barbados; Jordan & Evermann, l. c., 2301, 1898.

Family LXX. GOBIESOCIDÆ. Cling-fishes.

Body rather elongate, tadpole-shaped, broad and depressed in front, covered by smooth, naked skin; mouth moderate; upper jaw protractile; teeth usually rather strong, anterior conical or incisor-like; posterior canines sometimes present; suborbital ring wanting; no bony stay from suborbital across the cheek; opercle reduced to a spine-like projection concealed in skin, behind angle of large preopercle, this spine sometimes obsolete; pseudobranchiæ small or wanting, the gills 3 or 2.5; gill-membranes broadly united, free or united to isthmus; dorsal fin on posterior part of body, opposite to anal and similar to it, both fins without spines; ventral fins wide apart, each with 1 concealed spine and 4 or 5 soft rays. Between and behind ventrals is a large sucking-disk, the ventrals usually forming part of it. This sucking-disk, which is wholly different in structure from that of *Cyclopterus* and *Liparis*, is thus described by Dr. Günther:

"The whole disk is exceedingly large, subcircular, longer than broad, its length being (often) one-third of the whole length of the fish. The central portion is formed merely by skin, which is separated from the pelvic or pubic bones by several layers of muscles. The peripheric portion is divided into an anterior and posterior part by a deep notch behind the ventrals. The anterior peripheric portion is formed by the ventral rays, the membrane between them, and a broad fringe which extends anteriorly from one ventral to the other. This fringe is a fold of the skin containing on one side the rudimentary ventral spine, but no cartilage. The posterior peripheric portion is suspended on each side on the coracoid, the upper bone of which is exceedingly broad, becoming a free, movable plate behind the pectoral. The lower bone of the coracoid is of triangular form, and supports a very broad fold of the skin, extending from one side to the other and containing a cartilage which runs through the whole of that fold. Fine processes of the cartilage are continued into the soft striated margin, in which the disk terminates posteriorly. The face of the disk is coated with a thick epidermis, like the sole of the foot in higher animals. The epidermis is divided into many polygonal plates. There are no such plates between the roots of the ventral fins." (Günther, Cat., iii, 495.)

No air-bladder; intestines short; pyloric cæca few or none; skeleton firm; vertebræ 13 to 14 + 13 to 22 = 26 to 36.

Carnivorous fishes of small size and of no value as food, chiefly of the warm seas, usually living among loose stones between tide marks and clinging to them firmly by means of the adhesive disk. Their relations are obscure, but they are probably descended from allies or ancestors of the *Cottidæ* or the *Batrachoididæ*. Genera about 15; species 50. The principal genus is *Gobiesox*.

Genus 146. GOBIESOX Lacépède.

Body anteriorly very broad and depressed, posteriorly slender, covered with tough, smooth skin; opercle with a strong spine; head large, rounded in front; mouth terminal, crescent-shaped; lower jaw with a series of strong incisors in front, their edges rounded or truncate; upper jaw with a series of strong teeth, behind which are sometimes smaller teeth; no teeth on vomer or palatines; gills 3; gill-membranes broadly united under throat, not attached to isthmus; sucking disk large, posterior portion without anterior free margin. Dorsal and anal moderate, dorsal rays 6 to 12, anal rays 6 to 10. Vertebræ about 26, as far as known.

Species numerous, all American; mostly tropical, clinging to rocks near the shore.

Jordan & Evermann recognize 18 species of this genus in American waters; 5 of these are known only from our Pacific coast and the remaining 13 are all known only from the West Indies and the South Atlantic and Gulf coasts, though but one species has as yet been found in Porto Rico.

a. Dorsal fin moderate or short, its rays 6 to 11.

GOBIESOX:

b. Upper teeth in more than 1 series (character not verified in a few species); head broad.
c. Coloration in life chiefly olivaceous, with little red, sometimes banded with darker or paler.
d. Dorsal rays 12; anal rays 7 .... *gyrinus*
dd. Dorsal rays 11; anal rays 6; fins black .... *nigripinnis*
ddd. Dorsal rays 9 or 10; anal rays 6 .... *cephalus*
dddd. Dorsal rays 8; anal rays 6 .... *tudes*, 258
ddddd. Dorsal rays 11; anal rays 10 .... *strumosus*
dddddd. Dorsal rays 10; anal rays 8 .... *virgatulus*
cc. Coloration in life chiefly bright-red, or else with red spots or bands, color not fading in spirits.
e. Color uniform red, unspotted, color not fading in spirits; dorsal rays 6 to 8; anal rays 6.
f. Lower jaw with short incisors on each side, followed by canines .... *macrophthalmus*
ff. Lower jaw with 2 horizontal incisors on each side, third horizontal tooth not incisor-like; no distinct canines. *cerasinus*

SICYASES:

bb. Upper teeth in a single series (character not verified in some species): dorsal and anal short.
g. Color chiefly red.
h. Body with dark crossbands and with spots of clear blue; body rather slender. D. 6 or 7; A. 6...... *rubiginosus*
hh. Body plain, light red; form rather slender .... *carneus*
gg. Color olivaceous or brownish, not red.
i. Dorsal rays 9; anal rays 6.
j. Color olivaceous, without bands .... *hæres*
jj. Color greenish, with 3 dark crossbands and many dots .... *punctulatus*
ii. Dorsal rays 7; anal rays 7; body with dark crossbands .... *fasciatus*

258. Gobiesox tudes Richardson.

Head 2.5; depth 4.66; width of head 2.5; D. 8; A. 6 in plate (5 in description, the first short ray apparently not counted by Richardson). Head very broad, as broad as long, abruptly truncate anteriorly; mouth large, maxillary reaching front of eye; lower jaw included; teeth entire; eye large, 4.75 in head, a little more than half interorbital width, 1.5 in snout. Distance from front of dorsal to caudal about equal to length of head; insertion of dorsal before vent; anal behind dorsal and much shorter than it; pectoral short.

This is a very little known species, which reaches a length of 5 inches. The type locality is not certainly known, but it has been supposed to be China. It is, however, certainly not Chinese, and is now shown to be West Indian. A single specimen, 1.25 inches long, collected on the reef at Culebra Island February 9, agrees very well with the above description by Richardson. There are but 8 dorsal and 6 anal rays. The color is uniform pale-yellowish, with a slight tinge of rosy on middle of back; fins all pale; eye very large, about 3 in head, much larger than in specimens of *G. strumosus* of same size, and the interorbital width is decidedly narrower. It seems to be a good species, distinct from *G. cephalus* and *G. nigripinnis*.

Gobiesox tudes Richardson, Voy. Sulphur, Fish., 103, pl. 46, figs. 1-3, 1845, habitat unknown; supposed to be China; Jordan & Evermann, l. c., 2333, 1898.

Family LXXI. BLENNIIDÆ. The Blennies.

Body oblong or elongate, naked or covered with moderate or small scales which are ctenoid or cycloid; lateral line variously developed, often wanting, often duplicated; mouth large or small, teeth various; gill-membranes free from isthmus or more or less attached to it; pseudobranchiæ present; ventrals jugular or subthoracic, of 1 spine and 1 to 3 soft rays, often wanting; dorsal fin of spines anteriorly, with or without soft rays; anal fin long, similar to the soft dorsal; caudal well developed. Vertebræ in moderate or large number, 30 to 80.

Carnivorous fishes of moderate or small size, mostly living near shore in tropical and temperate or arctic seas; most of them are carnivorous, the *Clininæ*, so far as known, ovoviviparous, the others mostly oviparous. Genera about 80; species about 400; chiefly of rock pools and algæ; some species in the lakes of Italy. Of the 57 genera of this family recognized as American about 17 are found on our South Atlantic coast, and species of each may at any time be discovered in Porto Rican waters. At present, however, only 7 of these 17 genera are known to have Porto Rican species.

I. Tropical blennies, with vertebræ mostly in moderate number, usually fewer than 45; lateral line usually arched high above pectoral, if present; dorsal fin usually with at least one soft ray, none in some species of *Auchenopterus* and *Auchenistius;* anal spines little developed; ventral well developed, usually I, 3.

a. Body scaly.

CLININÆ:

b. Lateral line present, arched anteriorly over pectoral, becoming posteriorly median in position, or else obsolete; species ovoviviparous.

c. Scales ctenoid, very rough, 33 to 40 in lateral line; dorsal divided into 3 fins. An ocular cirrus present. GILLIAS, 147

cc. Scales cycloid; dorsal fin not divided into 3 fins.

d. Dorsal with 6 to 20 soft rays.

e. Shoulder-girdle without upturned hook on its inner edge above. Maxillary normal, not greatly expanded. Anterior part of lateral line normally formed; usually a comb of filaments at nape. Palatines without teeth; scales moderate or small, 38 to 110 in lateral line.

f. Teeth in jaws in 1 row only; teeth usually on vomer, none on palatines; usually a comb of filaments at nape. MALACOCTENUS, 148

ff. Teeth in jaws in more than 1 row, a band of villiform teeth behind others; teeth on vomer, none on palatines. Body oblong, depth 3.5 to 4.5 in length; a filament above eye .... LABRISOMUS, 149

dd. Dorsal with 1 short soft ray only; scales large; teeth in jaws in more than 1 series; teeth on vomer, none on palatines.

g. Dorsal fin more or less deeply notched behind the third spine. First 3 dorsal spines stiff, wide set, not remote from rest of fin behind dorsal notch; anal spines short; body more elongate, snout less acute.. AUCHENOPTERUS, 150

gg. Dorsal fin continuous, not notched .... PARACLINUS

bb. Lateral line absent .... AUCHENISTIUS, 151

aa. Body scaleless; species oviparous, so far as known.

h. Teeth comb-shaped, in a single row in each jaw, behind which are sometimes long canines; vomer and palatines usually toothless; lateral line usually single, with a strong arch anteriorly; dorsal fin long, continuous, or divided into 2 fins, anterior portion composed of spines, which are stiff or flexible; anal fin long, usually with 1 or 2 small spines; ventrals well developed, jugular, of 2 or 3 rays.

i. Teeth all fixed, attached to bone of jaw and not movable. Caudal fin rounded; teeth slender; gill-membranes not reduced to a small slit.

j. Gill-membranes free from isthmus, or at least forming a distinct fold across it.

k. Jaws one or both with a posterior fang-like canine, much longer than anterior teeth .... BLENNIUS

kk. Jaws without canines, teeth all equal .... SCARTELLA

jj. Gill-membranes broadly united to isthmus, gill-openings restricted to sides.

l. Jaws one or both with posterior fang-like canines .... HYPLEUROCHILUS

ll. Jaws without posterior canines; teeth equal; three articulated ventral rays.

m. Mouth small, maxillary extending scarcely beyond front of eye; head decurved in profile........ HYPSOBLENNIUS

mm. Mouth large, maxillary extending beyond vertical from middle of eye; head rather pointed in profile.. CHASMODES

ii. Teeth of front of jaws all movable, implanted on skin of lips.

n. Vomer toothless. Jaws one or both with posterior fang-like canines.

o. Dorsal fin continuous .... RUPISCARTES

oo. Dorsal fin divided .... ENTOMACRODUS

nn. Vomer with a few teeth; posterior canines small .... SALARIICHTHYS

hh. Teeth unequal, not comb-like; body oblong or elongate, more or less eel-shaped, naked, or rarely with rudimentary scales; supraocular flap sometimes present. Gill-membranes united, free from isthmus; dorsal fin very long, sometimes divided into 2 fins, formed of flexible spines, which often pass gradually into soft rays; anal fin long; ventral fins thoracic or subjugular, usually not much, if any, before pectorals, composed of 2 soft rays each, spine rudimentary; caudal well developed, dorsal and anal usually more or less joined to it at base.

OPHIOBLENNIINÆ:

p. Jaws with few teeth; a cirrus above eye and one above nostril; body scaleless and not eel-shaped; dorsal and anal free from caudal; dorsal fin notched.

q. Jaws each with 4 strong, hooked canines in front and a hooked posterior canine below; caudal fin forked. OPHIOBLENNIUS *qq.* Jaws each with 8 enlarged curved, conical teeth, not hooked, behind which is a single row of smaller ones; caudal fin not forked .... CORALLIOZETUS, 152

pp. Jaws with numerous teeth, not as above; caudal fin not forked.

EMBLEMARIINÆ:

r. Body not eel-shaped; dorsal and anal not joined to caudal; no scales; no cirri; no lateral line; ventrals before pectorals; teeth on palatines; caudal fin rounded. Dorsal fin very high, not notched, spines passing gradually into soft rays; jaws long, sharp at tip .... EMBLEMARIA, 153

Genus 147. GILLIAS Evermann & Marsh.

Body short and stout, tapering rapidly from the short, broad head to the short, compressed caudal peduncle; scales large, rough-ctenoid; lateral line complete, or nearly so, broken under last spines of middle dorsal; a broad, double-pointed tentacle above eye; dorsal fin divided into 3 parts, first of 3 short spines, second of 11 longer spines, and third of 7 rays.

This genus is closely related to *Enneanectes* Jordan & Evermann, differing in the presence of the orbital tentacle, the more complete development of the lateral line, and the larger scales.

Gillias Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 357 (*jordani*).

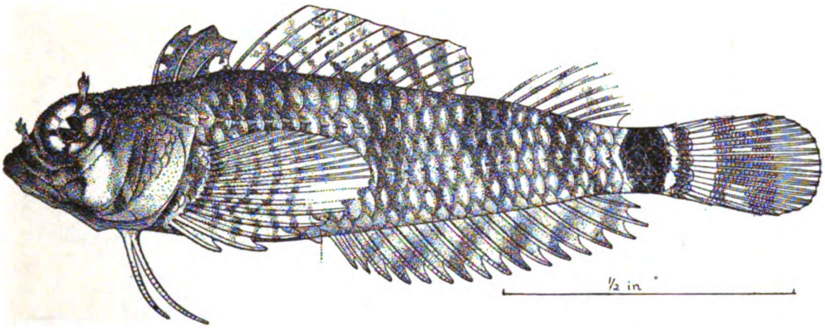

FIG. 95.—*Gillias jordani.*

259. Gillias jordani Evermann & Marsh.

Head 3.5; depth 4.3; eye 2.5; snout 3.5; maxillary 2.4; mandible 1.9; scales 2–33–3, 6 in transverse series; D. iii–xii–7; A. ii, 15; longest dorsal spine 1.8 in head, longest ray 1.6; longest anal ray 2.3; pectoral 0.8; ventral 1.3; caudal 1.3. Body short and stout, tapering rapidly to the short, compressed caudal peduncle; head short; snout short, blunt, concave in front of eyes; mouth small, slightly oblique, jaws equal; eye large, high up, interorbital width very narrow; a broad bifid orbital tentacle and a short nasal one; none on nape. Scales very large and rough-ctenoid; opercles and entire head rough; lateral line nearly complete, beginning immediately above base of pectoral at upper end of gill-opening and extending parallel with back to posterior part of middle dorsal fin (or for 12 scales), where there is a break, the line dropping down 3 scales, then continuing with one or two interruptions to base of caudal; belly and breast scaled; dorsals 3, first of 3 short, flexible spines, close to the second, which has 12 longer, rather stiffer, spines, separated from third by a space one-third diameter of eye; anal long and low, the membranes deeply notched between the rays; pectoral of 15 rays, broad and short, reaching posterior end of second dorsal; ventral of 2 slender rays.

Color in alcohol: Brown, body crossed by 4 broad blackish bars, one at origin of second dorsal, one under last spines of same fin, the third between second and third dorsals, and the fourth under third dorsal; an inky-black bar across caudal peduncle at base of caudal fin; head and under parts rusty; fins all barred with light and dark; caudal with a narrow light bar at base, then a black one, then a broader white one, followed by a much broader dark bar containing some white areas, the fin finally tipped with white.

Known only from Porto Rico. Two specimens of this well-marked and interesting species were obtained, the type, 1.5 inches long (No. 49368, U.S.N.M.), taken on the Cardona Light-house Reef, at Ponce, February 1, 1899, and another of about the same size taken at the same place the preceding day.

Gillias jordani Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 357, Cardona Light-house Reef, Ponce, Porto Rico.

Genus 148. MALACOCTENUS Gill.

This genus is very close to *Labrisomus*, differing in dentition, the teeth in the jaws being in single series; vomer with a few teeth or with none, and none on palatines. The dorsal fin has usually a notch behind the fourth dorsal spine as well as at front of soft dorsal, but in some species the notch is obscure. Most of the species are not well known, and perhaps more than one genus is here included. About a dozen species are recognized, only four of which are as yet known from Porto Rico, though several others may occur there.

a. Nape without filaments.
b. Orbital filament present.
c. D. xxi, 8; spinous dorsal not notched, first rays shortest; body elongate; snout pointed; scales large, about 38. *ocellatus*
cc. D. xx, 12; spinous dorsal weakly notched; body rather robust ...... *varius*
bb. Orbital filament wanting; dorsal rays xxi, 11; spinous dorsal weakly notched; ventrals long ...... *macropus*
aa. Nape with a single filament; a tentacle above eye.
d. D. xviii, 9 ...... *lugubris*
dd. D. xxi, 8; scales 35 ...... *culebræ*, 260
ddd. D. xxi, 11; scales 45 ...... *moorei*, 261
aaa. Nape with a comb of slender filaments; spinous dorsal more or less notched, behind fourth or fifth spine.
e. Orbital filament present. D. xviii to xx, 10 to 12; vomer with teeth.
f. Scales 43 or 44.
g. Highest soft ray of dorsal 1.5 to 1.9 in head; dorsal without ocelli.
h. A. ii, 17; first 3 dorsal spines wider apart than the others, the first longest; anal edged with dark ...... *gilli*
hh. A. ii, 19; first 3 dorsal spines not wider apart than the others, the second longer than the first; anal not edged with dark ...... *puertoricensis*, 262
gg. Soft rays of dorsal 1.2 in head; dorsal fin with 2 large black ocelli; ventral fins long, as long as head ...... *bimaculatus*
ff. Scales about 55; ventrals moderate, shorter than head ...... *delalandi*, 263
ee. Orbital filament wanting (no vomerine teeth?) ...... *versicolor*
aaaa. Nuchal and other filaments undescribed; a black ocellus on front of dorsal. D. xx, 11; scales 46 ...... *bigutlatus*

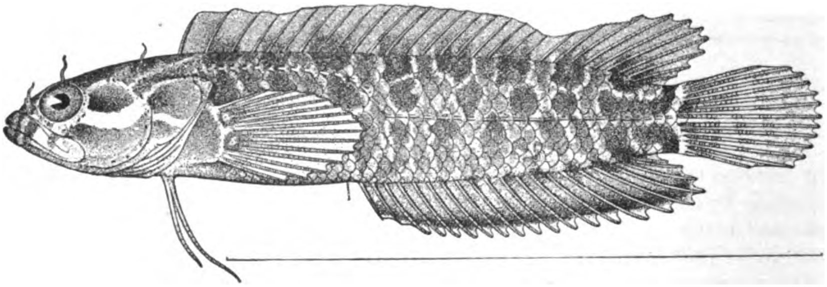

FIG. 96.—*Malacoctenus culebræ*.

260. Malacoctenus culebræ Evermann & Marsh.

Head 3.35; depth 5; eye 4.2; snout 4.5; maxillary 2.2; mandible 1.8; interorbital 6.5; scales 2-35-11; D. xxi, 8; A. ii, 18; pectoral 1.3; ventral 1.3; caudal 1.4. Body slender, compressed; head rather long, pointed, upper profile convex; mouth large, maxillary nearly reaching posterior border of orbit; lips thick, jaws equal; teeth very small, conical, a single row in each jaw; a single nasal, ocular, and nuchal filament; dorsal fin moderately high, originating above origin of lateral line, a shallow notch in front of last two dorsal spines, membrane free from caudal; anal origin under about tenth dorsal spine; caudal somewhat pointed; pectoral large, reaching anal; ventrals moderate, not reaching anus, of two rays, no spine evident; lateral line distinct throughout, running high anteriorly, where it is slightly curved, turning abruptly downward over origin of anal, thence median to base of caudal.

Color in spirits: Body everywhere mottled with dark brown, in somewhat regularly arranged blotches, a series of about nine of these at base of dorsal, barely extending upon fin; a similar series of much smaller ones at base of anal, not evident on all specimens; below the series at base of dorsal are two other series of the same blotches, less deep in color and not so well defined, extending the length of body and sometimes forming, with the upper series, more or less broken vertical bars; between the blotches a lighter shade of brown is interwoven with pale streaks of the ground-color; head nearly pale below, save some dark on chin and isthmus; two wide streaks from eye across cheek; opercle dark brown; top of head with color of body; lips with brown and pale stripes; posterior half of maxillary pale; dorsal rather dark; caudal uniform gray or faintly barred; anal similar to dorsal in color, rays with pale tips forming a white edge; pectoral like caudal; ventrals pale.

A rather plainly marked species of different aspect from other Porto Rican species of *Malacoctenus*, but not differing widely in any important character, and as yet known only from Porto Rico. It seems most closely related to *M. lugubris*. Three specimens of about the same size; the type, No. 49369, U. S. N. M., 1.38 inches in length, from reef outside Culebra Harbor, February 9, 1899.

Malacoctenus culebræ Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 357, Culebra Island.

261. **Malacoctenus moorei** Evermann & Marsh.

Head 3.6; depth 3.7; eye 3.5; snout 3.4; maxillary 3.5; mandible 4.5; interorbital 4; scales 3–45–7, 11 in transverse series; D. xxi, 11; A. ii, 20; pectoral 1 in head; ventral 1.2; caudal 1.2; longest dorsal spine 1.5, ray 1.2; longest anal ray 1.5. Body short, rather stout, compressed; head short, snout short, but pointed; mouth rather small, little oblique, gape scarcely reaching orbit; teeth in each jaw in a single series; gill-membranes broadly united across isthmus; eye small, interorbital space wide; dorsal outline rising abruptly to above eye, thence gently curved to origin of dorsal fin, and from there nearly straight to base of caudal fin; ventral outline regularly convex.

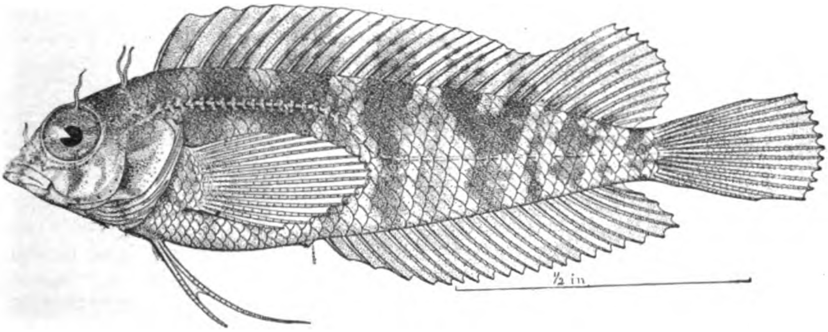

FIG. 97.—*Malacoctenus moorei.*

Color in alcohol: Light olivaceous, body crossed by about 9 or 10 dark broad vertical bars, which extend upon dorsal fin, these usually broadest above, pale interspaces therefore broadest on lower half of body; the fourth from last is a narrow dark line, the one following it is a double spot, the next narrow and indistinct, the last, at base of caudal, more distinct, followed by 3 small irregular white spots; top of head brown; side of head with fine punctulations; a dark line running forward from eye, a dark spot below eye, 2 or 3 dark blotches on anterior edge of opercle; under surface of head crossed by 3 or 4 irregular, indistinct dark lines; caudal and anal with fine dusky punctulations; pectoral and ventrals pale.

This species is close to *M. gilli*, from which it may be distinguished by the larger dorsal and anal fins, greater depth, wider interorbital, and the coloration. Known only from one specimen, 1.4 inches long, type No. 49370, U. S. N. M., collected at Culebra Island, February 11, 1899.

Malacoctenus moorei Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 358, Culebra Island.

262. **Malacoctenus puertoricensis** Evermann & Marsh.

Head 3.4; depth 3.4; eye 4; snout 3.5; maxillary 3.4; mandible 2.6; interorbital 7; preorbital 8; scales 4–44–8; D. xx, 10; A. ii, 19; P. 14; V. 2; C. 13. Body short, stout, compressed; head rather long, snout long and pointed; mouth small, little oblique, maxillary scarcely reaching the front of orbit; teeth in a single row in each jaw; gill-membranes broadly united, free from isthmus; eye high up, interorbital narrow; caudal peduncle short, compressed, its least depth about 3 in head. Fins rather large; origin of dorsal over upper end of gill-opening, first spine slightly shorter than second, which is somewhat longer than third, whose length is about 2.2 in head; no notch behind third and fourth spines, all spines from third to fifteenth being about equal in length, the sixteenth and seventeenth being somewhat shorter, the remaining three progressively longer; soft dorsal higher, its longest ray about 1.7 in head; longest anal ray 1.7; pectoral broad, 1.25 in head, reaching anal; ventral barely reaching origin of anal; a pair of slender ocular cirri, a small supraocular one, a short, slender, nasal cirrus and a few very slender ones at nape; scales large, not crowded anteriorly; lateral line well arched above pectoral.

Color in alcohol: Brown, much spotted and vermiculated with darker; top of head brown, side and under parts pale; side of body with about 6 or 7 broad, dark crossbars, broader than the paler interspaces, broadest and darkest above, and extending upon dorsal fin; under parts of body paler, more speckled; spinous dorsal with numerous small brown specks, a large black ocellus on base of 3 anterior spines, and a larger one on base of last 4 dorsal spines, being chiefly on body; soft dorsal, caudal, and anal each crossed by several series of small brown spots; pectoral and ventrals pale, pectoral with a few brown spots at base.

The above description from the type, a female, 2.5 inches long, No. 49371, U. S. N. M., obtained at Hucares, February 14. Three female cotypes, gotten at Fajardo, February 17, and one at Culebra, February 9, agree closely with the type; 2 of these, however, show faint traces of narrow horizontal lines along lower part of side.

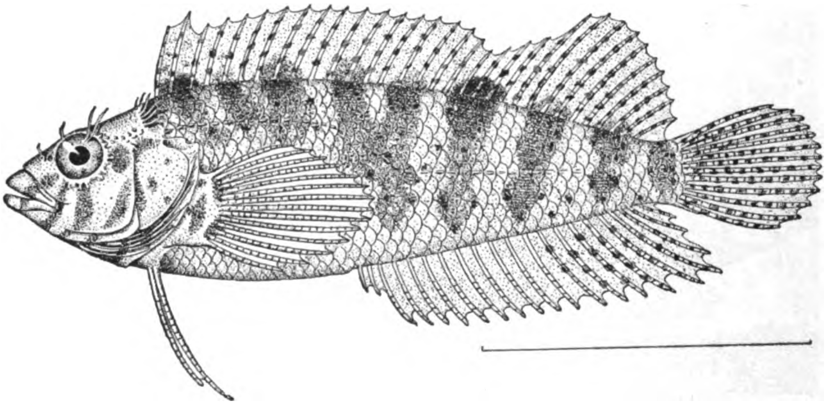

FIG. 98.—*Malacoctenus puertoricensis.*

A male, 2.5 inches long, from Culebra, February 11, taken as one of the cotypes, may be described as follows: Head 3.5; depth 3.7; eye 3.8; snout 3.2; maxillary 3.1; mandible 2.4; interorbital 7; preorbital 6.2; scales 3–45–9; D. xx, 10; A. ii, 19; P. 14; V. 2; C. 13; longest dorsal spine 2 in head, longest ray 1.4; longest anal ray 1.5; pectoral 1; ventral 1.1; caudal 1.1. Color in alcohol: Tolerably uniform brown; crossbars on side very faint; longitudinal lines more evident than in female; throat and under parts of head mottled with white and light-brown; fins less speckled than in female, soft dorsal and anal pale, almost without spots.

Another male, 2.25 inches long, from Culebra, February 11, agrees with the large specimen just described, except that the crossbars on body are more distinct.

This species most closely resembles *M. bimaculatus* Steindachner, from which it differs in the larger head, greater depth, smaller mouth, narrower interorbital, and in the color. The tips of anal rays are not white, soft dorsal is spotted like caudal and anal, and there are no white spots on base of pectoral, as is said to be the case in *M. bimaculatus.*

Malacoctenus puertoricensis Evermann & Marsh, Report U. S. F. C. 1899 (Dec. 19), 358, Hucares, Porto Rico.

263. **Malacoctenus delalandi** (Cuvier & Valenciennes).

Head 3.4; depth 4; eye 3.5; snout 3.3; maxillary 3.3; mandible 2.6; interorbital 7; preorbital 6.2; scales 4–53–10; D. xx, 10; A. ii, 19; longest dorsal spine 2.2; longest ray 1.6; longest anal ray 1.8; pectoral 1.1; ventral 1.2; caudal lobes 1.4. Body compressed, heavy forward; head short, snout short, decurved; mouth rather large, maxillary scarcely reaching eye; gill-membranes free and broadly united across isthmus; teeth in a single series in each jaw; a few teeth on vomer, none on palatines; eye large, above axis of body; small cirri above eye and a small nuchal fringe of filaments somewhat longer than ocular ones; scales moderate, lateral line arched above pectoral, strongly decurved posteriorly; belly naked anteriorly; first dorsal spine a little longer than second, which in turn is much longer than third, which is shorter than fourth; from the fifth to about the fourteenth increasing slightly in length, then regularly decreasing to the last but two, which is scarcely half as long as longest spines; last but one a little longer, and last about as long as fourth; soft dorsal considerably higher than spinous part; anal long, lower than soft dorsal, membrane deeply notched except among last 4 rays, which are longest.

Color, olivaceous-gray, darkest above; side crossed by about 6 irregular, broad vertical bars, first at base of pectoral, last at base of caudal fin, each of these bars consisting really of 3 large brownish blotches, middle one largest and plainest, the lower least distinct; belly and breast pale; head olivaceous; cheek and opercles crossed by darker bands; under side of head crossed by about 4 distinct dark bands separated by white of somewhat greater width; fins all uniform pale, except spinous dorsal, which has a dark blotch upon first 3 spines.

This species ranges from the West Indies to Brazil, and is also found on the west coast of Mexico north to Mazatlan, where it is the most abundant species occurring in the rock pools, if *Clinus zonifer* Jordan & Gilbert be the same species. We have compared specimens from the west coast with ours from Porto Rico and can detect no tangible differences. From Porto Rico we have 3 specimens, each about 1.75 inches long, from Ponce and Hucares.

Clinus delalandi Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 378, 1836, Brazil.
Clinus zonifer Jordan & Gilbert, Proc. U. S. N. M. 1881, 361, Mazatlan, Mexico.
Malacoctenus delalandi, Jordan & Evermann, l. c., 2358, 1898.

Genus 149. LABRISOMUS Swainson.

Body oblong, robust; head naked, short, compressed above; mouth rather large, with a row of stout, bluntish teeth in front of each jaw, behind which is a band of smaller teeth, broadest in lower jaw; teeth on vomer, no teeth on palatines; a tentacle above eye; side of neck with a tuft or series of fine filaments; dorsal fin continuous, with numerous slender spines and many soft rays, spines not very unequal; pectoral long; lateral line continuous; scales moderate or small, cycloid; shoulder-girdle without upturned hook-like process on its inner edge. Intestinal canal short, shorter than body.

The limits of this genus are not well defined. It differs from *Clinus* chiefly in the absence of an upturned spine-like process on inner edge of shoulder-girdle. This process is found on *Clinus acuminatus*, the type of the genus *Clinus*.

This genus has five American species, only one of which is yet known from Porto Rico.

a. Scales moderate, about 70 in lateral line (so far as known); soft dorsal with 11 to 13 rays.
  b. Dorsal spines 16; anal rays 20; tentacles on nape .... *herminier*
  bb. Dorsal spines 18; no teeth on palatines; first ray of dorsal not longest; orbital tentacle well developed; nape with a conspicuous comb of fringes.
    c. Vomer with a cluster of small teeth .... *nuchipinnis*, 264
  bbb. Dorsal spines 20; teeth on palatines (?); first dorsal spine longest .... *bucciferus*
aa. Scales very small, about 110; a comb of fringes at nape; first dorsal spines low; head with yellow spots. *microlepidotus*

264. Labrisomus nuchipinnis (Quoy & Gaimard).

(PLATE 46.)

Head 3.5; depth 3.5; D. XVIII, 12; A. II, 17; scales 70. Body oblong, rather robust; head naked, thick, short, not very obtuse anteriorly, compressed above; mouth rather large, the maxillaries not prolonged backward, extending to opposite posterior part of eye, 2.5 in head; front teeth of jaws conic, strong, behind them a band of villiform teeth, broadest in lower jaw; vomer with a patch of smallish teeth; eye large; interorbital space very narrow; each side of neck with a long series of hair-like filaments, nearly as long as eye; orbital tentacle short and broad, multifid; nostril with a tufted barbel; lower jaw slightly projecting, its posterior teeth sometimes recurved; pectoral a little shorter than head, reaching vent. Dorsal spines rather slender, the 3 anterior spines scarcely shorter than the others, all the spines lower than soft rays; dorsal fin commencing near nape, spinous portion long; soft rays higher than the spines; caudal small; pectoral rather large; ventrals moderate; gill-membranes broadly united, free from isthmus; lateral line complete, high anteriorly, then abruptly decurved; membranes of vertical fins scaly; scales not very small, cycloid.

Color in life: Body mottled yellow-olivaceous, crossed by about 7 broad black vertical bars, the first extending from origin of dorsal to upper edge of opercle, second from fifth dorsal spine to base of pectoral, next 3 extending entirely across side, sixth from base of soft dorsal to median line, and seventh consisting of 2 or 3 black blotches upon upper part of caudal peduncle; a round jet-black spot as large as pupil upon opercle, surrounded by a narrow line of orange or yellow; cheek and upper parts of head like side; throat and breast pale-rosy; branchiostegals white with about 4 series of black spots on membranes; belly pale; dorsal fin yellowish at base, pale bluish-white on outer half, both spinous and soft portions with numerous small reddish spots; a round black spot between first and third dorsal spines; caudal pale; anal yellowish at base, paler on outer half; pectoral pale with numerous small reddish spots; ventral pale; nuchal filaments reddish-brown; iris reddish-brown.

The color on this species seems to be subject to considerable variation; we have the following note on a specimen obtained at Mayaguez: Side greenish-gray, with about 6 dark crossbars extending upon dorsal fin, bifid above; cheek and throat vermilion; inside of the mouth and breast vermilion, becoming golden posteriorly; cheek with many pale-blue spots; similar spots on top of head and base of pectoral and paler ones on lower part of side; a large black spot bordered by white on opercle, bounded on front and above by rich metallic-rosy; dorsal lemon barred with brown; anal lemon-yellow with pale darker bars; caudal plain lemon, faintly barred; pectoral lemon, with faint bars; ventral rosy; cirri barred with pale-yellow and dark-brown; 6 dark bars on spinous dorsal and 2 on soft, second one faint; a large black spot between first and third dorsal spines; iris with purplish-red spots.

West Indies, north to southern Florida, south to Brazil; generally common in rocky pools; also recorded from the Canary Islands. Length 6 to 8 inches. Common in Porto Rico, specimens being in the collection from San Antonio Bridge, Palo Seco, Mayaguez, Puerto Real, Ponce, Arroyo, Fajardo, Isabel Segunda, and Culebra.

Clinus nuchipinnis Quoy & Gaimard, Voy. Uranie et Physicienne, Zool., 255, 1824, Brazil.
Clinus pectinifer Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 374, 1836, Bahia.
Lepisoma cirrhosum De Kay, N. Y. Fauna: Fishes, 41, 1842, Florida.
Clinus canariensis Valenciennes, in Webb & Berthelot, Poiss. Iles Canaries, 60, 17, fig. 3, Canary Islands.
Labrisomus nuchipinnis, Jordan & Evermann, l. c., 2362, 1898.

Genus 150. AUCHENOPTERUS Günther.

Body moderately elongate, compressed, covered with rather large, cycloid scales; head shortish, naked, snout rather pointed; cheek full; mouth moderate, with a band of conical teeth in jaws and about one series on vomer, none on palatines; lower jaw prominent; gill-membranes united, free from isthmus; upper surface of head with filaments. Dorsal fin composed of stiff spines, with but a single soft ray, which is lower than the spines; first 3 spines more or less separated from others, stiff and rather wider set, sometimes higher than the others; anal fin low, with 2 short spines; ventrals jugular, well developed; pectoral broad; lateral line complete, strongly curved anteriorly.

An inhabitant of the warm seas. This genus differs from *Cristiceps* in the large scales and in having but 1 soft ray in dorsal fin. Of the dozen recognized American species of *Auchenopterus*, 5 are known from Porto Rico, and some of the others may occur there.

CORALLICOLA:
a. First 3 spines of dorsal forming a separate fin, being much higher than any of the spines in the posterior part of fin; snout rather acute.
b. Scales 38; dorsal with 1 ocellus, anal with none; a black crossbar at base of caudal; a yellow spot behind eye; snout pointed .... *nigripinnis*
bb. Scales 37 or 38.
c. First dorsal spine shorter than second; snout slender, very acute; caudal pale; dorsal with 2 ocelli, anal with 1; D. III–XXII, 1 .... *marmoratus*.
AUCHENOPTERUS:
aa. First 3 spines of dorsal scarcely forming a separate fin, none of them higher than posterior spines; snout not very acute; anal without ocellus.
d. Caudal fin pale, usually with a dark bar at its base; a notch between third and fourth dorsal spines.
e. Dorsal spines about 31.
f. Scales 34 to 36.
g. Membrane of third dorsal spine joining fourth spine near its base .... *affinis*
gg. Membrane of third dorsal spine joining fourth spine near its tip.
h. Caudal fin white, with a broad, black bar on its base; body dark, no crossbars; scales 2-34-3, 7 in transverse series; D. XXX, 1 .... *albicaudus*, 265
hh. Caudal fin mottled, a narrow white bar near base, before which is a broader dark bar; body with about 7 dark crossbars; scales 2-34-3, 7 in transverse series; D. XXIX, 1 .... *fajardo*, 266

bbb. Caudal fin pale, no dark bar at base; body pale rosy, no crossbars; scales 2-33-3, 7 in transverse series; D. xxx, 1 .... *rubescens*, 267

cc. Dorsal spines about 28; membrane of third dorsal spine joining fourth spine near its tip; body with distinct crossbars.

i. Dorsal xxx, 1, with a distinct ocellus; scales about 2-31-3, 7 in transverse series........ *fasciatus*, 269

ii. Dorsal xxviii, without ocellus; scales 2-30-3, 7 in transverse series........ *cingulatus*, 268

dd. Caudal fin black; body chiefly black; head mottled with whitish; membrane of third dorsal spine joining fourth near its summit, fin not notched; dorsal spines 30; dorsal with 2 ocelli .... *nox*

265. **Auchenopterus albicaudus** Evermann & Marsh.

Head 3.2; depth 4; eye 4; snout 4.1; maxillary 2.2; mandible 1.6; interorbital 5.3; D. xxx, 1; A. ii, 17; pectoral 1.4; ventral 1.5; caudal 1.6; branchiostegals 6; scales 2-34-3, 7 in transverse series.* Body rather short, compressed; dorsal outline not elevated; head moderate, not broad; snout short, pointed; mouth large, oblique, maxillary extending to below middle of eye; lips broad, prominent; a band of conical teeth on each jaw, those on side somewhat enlarged and recurved; a patch of teeth on vomer, none on palatines; gill-membranes broadly united, free from isthmus; eye large, high up; nasal, supraocular, and nuchal region with fringed tuft-like cirri; a considerable notch between third and fourth dorsal spines, but not reaching base of membrane; longest anterior spine scarcely as long as those of posterior portion; scales large, reduced anteriorly; lateral line anteriorly separated from dorsal fin by only one scale; head naked.

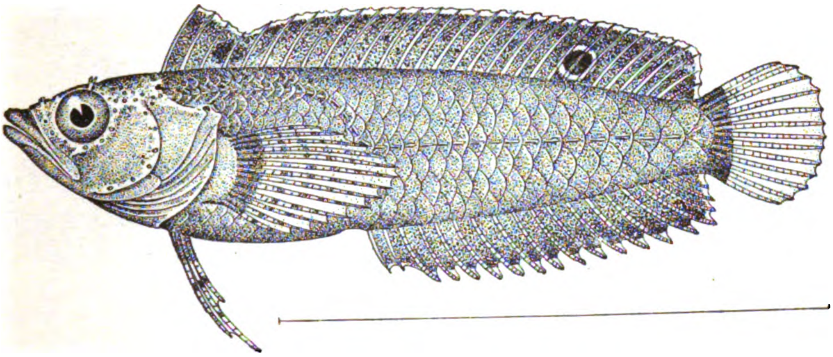

FIG. 99.—*Auchenopterus albicaudus.*

Color, uniform dark brown on head and body, no dark crossbars; dorsal brown, mottled with lighter, narrowly edged with white; a black spot upon anterior 3 or 4 spines and a large black ocellus upon posterior portion of fin between twenty-second and twenty-fourth spines; anal rather darker, with narrow white edge; caudal peduncle black, fin abruptly white at base, entire fin being clear white, without specks; pectoral black at base, then barred with white and dark; ventral black at base, outer two-thirds barred with black and white.

This species seems to be related to the Pacific coast *Auchenopterus integripinnis*, which it closely resembles, differing in the larger scales, deeper body, and coloration.

Known only from the type, seined at Arroyo, Porto Rico, February 4.

Auchenopterus albicaudus Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 360, Arroyo, Porto Rico.

266. **Auchenopterus fajardo** Evermann & Marsh.

(PLATE 47.)

Head 3.25; depth 4.8; eye 4.2; snout 4.8; maxillary 1.7; mandible 1.5; interorbital 5.5; scales 2-34-3, 7 in transverse series; D. xxix, 1, the longest spine 2.3 in head; A. ii, 17; pectoral 1.4; ventral 1.7; caudal 1.4. Body elongate, strongly compressed posteriorly; head moderate, little compressed; mouth large, the long and slender maxillary reaching beyond posterior border of orbit; jaws subequal;

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* In our descriptions of species of this family the scales are counted from near front of dorsal to and including lateral line, then in lateral line, then from origin of anal upward and backward to lateral line, the transverse series being counted from origin of anal upward and backward to dorsal fin. The half scale at base of dorsal and anal is not counted.

teeth of upper jaw conical and sharp, in a patch in front, becoming one row posteriorly; teeth in lower jaw similar, but fewer and weaker; vomerine teeth in two series. Nasal, ocular, and nuchal filaments present, all but the nasal about 5-branched. Dorsal origin over edge of preopercle, first 4 spines graduated, fourth shortest, thus forming a notch; dorsal ending with an unbranched soft ray, the joints visible under a strong lens; membrane of dorsal joined low to caudal; anal origin under eleventh dorsal spine and decurved portion of lateral line; pectoral reaching past front of anal; ventral moderate, of 3 rays, innermost shorter and slenderer.

Color in spirits: Body and head light-reddish, becoming a little paler posteriorly; body with traces of 6 or 8 dark vertical bars extending on the fins, their margins ill-defined; breast pale, 2 dark-reddish bars downward and backward from eye across upper and lower edge of cheek to opercle; maxillary blotched with dark; upper lip and tips of both jaws dark; lower part of head spotted with dark; a row of about 5 small dark spots on edge of preopercle; iris pink; dorsal and anal fins gray, except for extensions of dark bars of body and a few white spots on dorsal; a distinct ocellus on twenty-second, twenty-third, and twenty-fourth dorsal spines and their membranes; base of caudal gray, like ground-color of dorsal and anal; posterior part of caudal with gray mottlings on rays only, this portion separated from the basal part by a space without pigment on rays or membrane, making a distinct vertical bar; pectoral and ventrals mottled.

A handsomely colored blenny, of which the collection contains but one specimen, the type, No. 49376, U. S. N. M., 1.63 inches long, taken at Fajardo, Porto Rico, February 17, 1899.

Auchenopterus fajardo Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 361, Fajardo, Porto Rico.

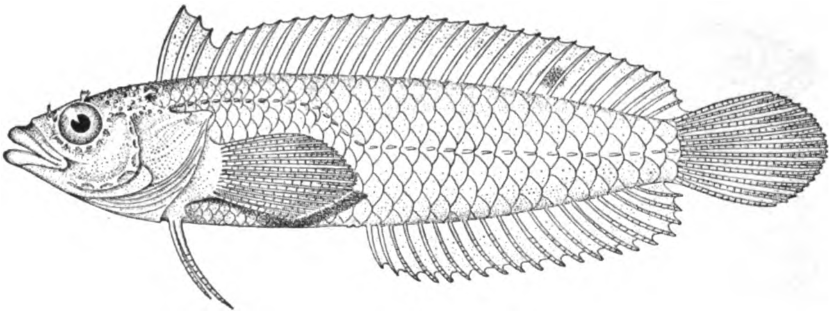

FIG. 100.—*Auchenopterus rubescens.*

267. Auchenopterus rubescens Evermann & Marsh.

Head 3.4; depth 5; eye 5; snout 3.8; maxillary 2.6; interorbital 5.8; scales 2–33–3, 7 in transverse series; D. xxx, 1; A. ii, 18; pectoral 1.5; ventral 2; caudal 1.4. Body slender and compressed; head moderate, somewhat compressed above; snout pointed; mouth moderate, jaws equal, maxillary about reaching front of pupil; lips, especially upper, prominent; teeth small, conical, and sharp, in both jaws, in a numerous patch on front of upper jaw, fewer on sides; in lower jaw less numerous in front, a long single row of somewhat stronger teeth on sides; eye not large; a small nasal flap, and a 3 or 4 branched filament over eye and one at nape; scales rather large and regularly arranged; dorsal fin with a notch behind third spine, and with one unbranched soft ray at its end, membrane joined to caudal; origin of anal under eleventh dorsal spine.

Color in spirits: Everywhere a nearly uniform faded pink, save breast and lower side of head, which are paler; a small, inconspicuous dark round spot on dorsal fin, at twenty-third and twenty-fourth spines, a little nearer the base than margin, and made up of very small black punctulations. Indications of a yellow tinge on front of dorsal and base of anal in life; fins otherwise all pale.

Known only from the type, 1.3 inches long, collected at Puerto Real, Porto Rico.

Auchenopterus rubescens Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 360, Puerto Real, Porto Rico.

268. Auchenopterus cingulatus Evermann & Marsh.

Head 3; depth 4.4; eye 5; snout 4.2; maxillary 2.2; interorbital 6; scales 2–30–3, 7 in transverse series. D. XXVIII, the longest spines 2.75 in head; A. II, 16, the longest ray 2.75 in head; pectoral 1.3; ventral 1.8; caudal 1.6. Body rather long and slender, strongly compressed; head large, little compressed; snout moderately sharp; mouth large, maxillary reaching posterior border of eye, lips heavy, jaws subequal or lower very slightly projecting; teeth conical and sharp, in more than one row in each jaw, most numerous in front; a patch on vomer; a nasal filament, a 3 or 4 branched supraocular filament, and a 4-branched nuchal filament, branches of latter each with a dark dot on its anterior surface; dorsal originating over edge of preopercle, of spines only, second slightly longer than first; second, third, and fourth graduated, fourth comparatively short, thus forming a notch partly separating first spines from rest of fin; dorsal membrane joined low with caudal; anal free from caudal, about as high as dorsal, its thirteenth and fourteenth rays longest; first anal spine under tenth or eleventh dorsal spine; caudal rounded, shorter than head, of about 13 rays; pectoral large, reaching anal, of 12 rays; ventrals moderate, of 2 rays, spine not evident; lateral line running high to eleventh dorsal spine, here abruptly decurved two rows of scales, thence median to base of caudal.

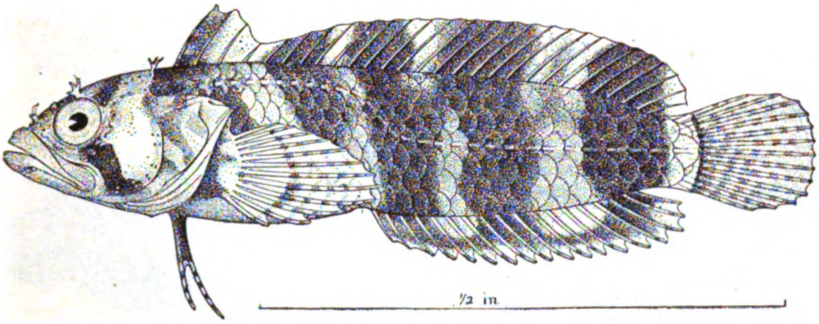

FIG. 101.—*Auchenopterus cingulatus.*

Color in spirits: Body and head pale-yellow; body with 5 heavy dark-brown vertical bars, each about 4 rows of scales wide, extending on vertical fins; membrane of anterior dorsal spines, opercle, occipital, and scapular region blotched with same color; a dark bar backward and downward from eye across cheek, rather more than one-half width of eye; top of head between and behind eyes darkened; preorbital, maxillary, lips, and under part of head thickly punctulate with dark; dorsal and anal barred with extensions of the wide, dark body-bars, and with alternating narrower pale interspaces; caudal mottled or irregularly barred with grayish, its base with the plain pale-yellow ground-color, which is sharply separated from rest of fin by a curved dark line; posterior half of pectoral with dark bars formed of dots on rays, first bar plainest; basal half of pectoral pale; ventral with basal portion dark, rest barred like pectoral.

A pretty and strongly marked blenny, known only from Porto Rico; four specimens obtained from the coral reefs at Ponce, and one at Puerto Real. The type, No. 49375, U. S. N. M., from Ponce, is 0.8 inch long, and none of the cotypes exceeds 1 inch.

Auchenopterus cingulatus Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 361, Ponce, Porto Rico.

269. Auchenopterus fasciatus (Steindachner).

Head 3.5; depth 4.6; eye 4.5; snout 4.2; maxillary 2.3; mandible 2; interorbital 5.4; scale 2–31–3, 7 in transverse series; D. XXX, 1; A. II, 17; P. 1.3 in head; V. 1.4; C. 1.4. Body slender, compressed, head narrow, snout pointed; mouth rather large, lower jaw slightly projecting, maxillary reaching posterior edge of pupil; gill-membranes broadly united across isthmus; eye small, above axis of body; profile rising gently and regularly from tip of snout to origin of dorsal fin, from which it continues in a nearly straight line to caudal peduncle; a small ocular cirrus and a small one on side of nape; fourth and fifth dorsal spines shorter than those before or after, others of approximately equal length; anal rays about as long as dorsal spines, the tips projecting beyond membrane; scales large, cycloid; belly, breast, nape, cheek, and opercles scaled; lateral line complete, arched above pectoral, running on third row of scales from back for about 13 scales, where it drops to fifth row.

Color in alcohol: Somewhat rosy-brown, with faint traces of darker vertical bars; anterior part of eye dark, head uniform rosy-brown without markings; dorsal fin with 8 broad, dark bars, the first on first 2 or 3 spines and forming a small black spot near their tips, seventh between twentieth and twenty-fourth spines and containing a distinct ocellus, probably blue in life; anal with 5 broad black bars, but no ocellus; a dark bar across base of caudal, rest of fin pale; pectoral faintly and finely barred with dark.

This blenny reaches a length of 2 inches and is known from southern Florida (Cards Sound, Key West) and Porto Rico. One specimen, 1.25 inches long, obtained at Hucares, February 14, agrees in the main with current descriptions of this species. The dorsal spines, however, are more numerous and the color seems to be somewhat different. Without more material we hesitate to regard these as being of specific value.

Cremnobates fasciatus Steindachner, Ichth. Beiträge, V, 176, 1876, Florida Straits.
Auchenopterus fasciatus, Jordan & Evermann, l. c., 2373, 1898.

Genus 151. AUCHENISTIUS Evermann & Marsh.

This genus has the form of *Auchenopterus* and suggests that genus strongly. It differs in the absence of a lateral line, in the much smaller scales, in the absence of a notch at front of dorsal fin, and in the union of the membrane of the anal fin with that of the caudal. Only one species known.

Auchenistius Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 359 (*stahli*).

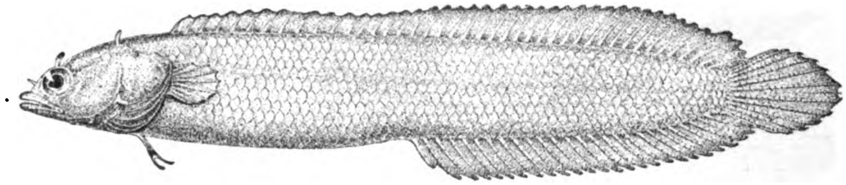

FIG. 102.—*Auchenistius stahli.*

270. Auchenistius stahli Evermann & Marsh.

Head 5; depth 6.5; eye 4.8; snout 6; maxillary 2.8; scales about 58, about 13 in transverse series; D. XLI or XLII; A. I or II, 23 or 24; pectoral 2.5; ventral 2.2; caudal 1.3. Body elongate, somewhat compressed, especially posteriorly, dorsal and ventral outlines alike; head small, upper profile straight and descending; snout moderate, pointed; mouth large, maxillary reaching to or beyond middle of eye; jaws equal, heavy and projecting; teeth in lower jaw conical, short and strong, slightly recurved, in one row; teeth in upper jaw similar to those in lower, but a small patch of smaller teeth in front of jaw behind main row; teeth on vomer; gill-membranes joined to isthmus; nostrils with short tubes, a single flap above each eye and one on each side of nape; dorsal fin long, of spines only; last four spines somewhat longer than the preceding, forming a shallow notch, a feature not present in all examples; anal origin about midway between tip of snout and tip of caudal, fin similar to dorsal in shape, somewhat higher in type, but a trifle lower in cotype; membrane of dorsal and anal joined to caudal; caudal small, pointed; pectoral small, of 8 rays; ventral small, of 2 rays.

Color in spirits: Body everywhere with a very slight yellowish tinge, in some specimens a faded gray; one specimen has traces of 10 or 12 dark crossbars; fins all pale, in one case the dorsal and anal dark-edged.

This species is known only from the type, 1.2 inches long, No. 49372, U. S. N. M., from Ponce, February 1, 1899, and 13 cotypes, 8 from the coral and algæ on the reefs at mouth of Culebra Harbor, February 11, and 5 from Puerto Real.

Named for Dr. A. Stahl, of Bayamon, Porto Rico, who, under many difficulties, has made considerable collections of the natural-history objects of Porto Rico.

Auchenistius stahli Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 359, Ponce, Porto Rico.

Genus 152. CORALLIOZETUS Evermann & Marsh.

Body slender and strongly compressed, without scales; head large, subcylindrical, bluntly pointed; mouth large; teeth not hooked, about 8 enlarged conical ones in front of each jaw, smaller ones behind; vomer with teeth; dorsal fin with a notch between rays and spines; the membrane slightly connected with caudal; caudal fin rounded; pectoral large, ventrals small and inserted slightly in advance of pectorals. A strongly marked genus, conspicuous in appearance by its heavy head and thin body; probably related to *Ophioblennius*, from which it is technically separated by absence of hooked canine teeth, convex caudal, and entire absence of a lateral line. Only one species known.

Coralliozetus Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 362 (*cardonæ*).

271. Coralliozetus cardonæ Evermann & Marsh.

Head 4; depth 5.6; eye 4; snout very short; maxillary 2; D. XVII, 11; A. 21; pectoral 1.3; ventral 1.8; caudal 1.4. Body scaleless, slender, much compressed; head large and heavy, not compressed nor depressed; snout very short and blunt; mouth large, horizontal, low in position, maxillary reaching far beyond eye; eyes small, close together, placed high and well forward; teeth conical, in a patch on the front of each jaw, an outer row of about 8 teeth (4 on a side) in each jaw, much enlarged; a single row of smaller teeth on sides of each jaw; teeth on vomer; a small flap at nostril and two short filaments above eye, one much the smaller; no appendages at nape. Dorsal fin long and high, of slender, flexible spines, and longer, soft rays, a notch between fourth and fifth spines, last ray slightly connected with caudal; anal longer and lower than soft dorsal, free from caudal; caudal rounded; pectoral large, nearly as wide as body, reaching anal or beyond; ventral small, inserted before pectoral, of 3 rays, innermost very slender.

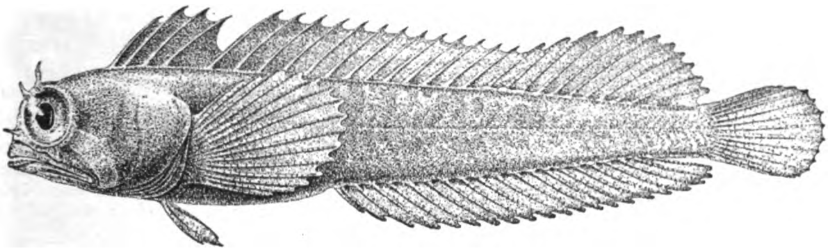

FIG. 103.—*Coralliozetus cardonæ.*

Color in spirits: Body dark-red, much paler in one specimen; head everywhere bluish-black, this color dusted upon body, particularly on anterior portion; a pale-gray bar downward and backward across cheek; fins pale, except ventrals and front of dorsal, which have color of head; a row of small rosy spots along bases of anal rays, seemingly in the flesh; sometimes a similar fainter row along base of dorsal.

Known only from Porto Rico; three specimens, 0.87 to 1 inch in length, taken on the coral reefs at Ponce on three successive days; type, No. 49377, U. S. N. M., 1 inch long, collected February 1, 1899.

Coralliozetus cardonæ Evermann & Marsh, Rept. U. S. F. C. 1899 (Dec. 19), 362, reef at the Cardona Light-house, Playa de Ponce, Porto Rico.

Genus 153. EMBLEMARIA Jordan & Gilbert.

Body slender, not eel-shaped, compressed, scaleless. Ventrals present, jugular, each of 1 spine and 2 soft rays. A single high dorsal fin beginning on nape and extending to caudal, with which it is not confluent; no notch between spinous and soft rays. Head cuboid, compressed, narrowed anteriorly. Symphysis of lower jaw forming a very acute angle. A single series of strong, blunt, conical teeth on each jaw, and on vomer and palatines. Vomer and palatine teeth larger, their series continuous, parallel to series in upper jaw. No cirri at nape; sometimes a cirrus on upper part of eyeball. Gill-openings very wide, membranes broadly united below, free from isthmus. Lateral line obsolete.

This genus bears some resemblance to *Blennius*, but the dentition is entirely different, approaching that of *Chænopsis*. An inhabitant of tropical America, in rather deep water; 4 species known, 2 of which are Atlantic.

a. Eye without cirrus.
b. Depth 5 in length; dorsal rays 33; ventrals not pure white .... *atlantica*
aa. Eye with a long cirrus on eyeball above pupil.
c. Maxillary longer, reaching posterior edge of orbit; body without dark crossbar; ventrals pale; tip of caudal not black .... *pandionis*, 272

272. **Emblemaria pandionis** Evermann & Marsh, new species.

Head 3.7; depth 5.8; eye 3.6; snout 5; maxillary 2; mandible 1.8; D. xvii, 18; A. ii, 23; P. 13; V. i, 2; C. 13. Body slender, tapering, greatly compressed; head comparatively heavy; snout short, decurved; mouth large, horizontal, maxillary reaching posterior border of eye; each jaw with a patch of teeth in front, outer enlarged, bluntly conic, slightly incurved, these continued laterally on upper jaw in a single series of similar but smaller teeth, and on lower jaw in a single series of similar but smaller, blunter teeth; palatines each with a row of blunt teeth; vomer probably without teeth; no teeth on tongue. Fins moderate, rays not filamentous; first 17 rays of dorsal simple, not jointed nor branched, remaining rays jointed and elevated, longest a little greater than snout and eye, the two anterior rays of anal not jointed nor branched; pectoral broad, short, its length 1.3 in head; ventral longer, filamentous, 1.2 in head; caudal short, pointed, 1.8 in head. An unbranched ocular cirrus on upper part of eye, its length about one-third that of eye; nasal tube slender and simple.

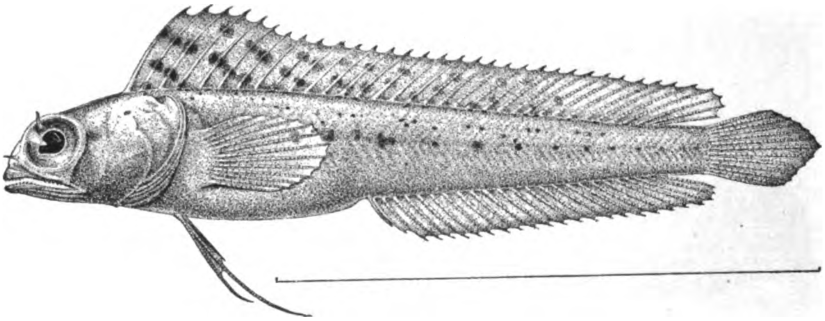

FIG. 104.—*Emblemaria pandionis.*

Color in alcohol: Pale flesh-color; middle of side with a series of about 15 small brown blotches, largest anteriorly; above these and along base of dorsal are 2 or 3 irregular series of smaller dark spots, those along base of dorsal quite black; a similar series along base of anal; head spotted like body; dorsal fin with numerous dark spots and blotches, most distinct anteriorly; caudal and anal fins somewhat dusky; pectoral and ventral pale; a few small brownish specks on throat and on breast in front of ventrals; a very dark-brown, almost black, oblong spot, placed obliquely on lower part of side above tenth anal ray, a narrow bar of same color just in front of it; this conspicuous color-marking present on left side only.

Known only from the type (No. 49535, U. S. N. M.), 1.5 inches long, caught in the tangle at Fish Hawk station 6084, between Vieques and Culebra islands, in 11 fathoms, and one cotype of same size taken in the dredge at Fish Hawk station 6086, 8.5 miles northeast from Isabel Segunda, Vieques Island, in 14.75 fathoms, the bottom at each station being coral, sand, and shells.

This interesting species is related to *E. oculocirris* Jordan, from La Paz, Lower California, from which it seems to differ chiefly in the longer maxillary and in the coloration.

Named for the U. S. Fish Commission steamer *Fish Hawk*, *Pandion* being the generic name of the fish-hawk or osprey, *Pandion carolinensis*.

Family LXXII. FIERASFERIDÆ. The Pearl-fishes.

Body elongate, compressed, tapering into a long and slender tail; no scales; teeth cardiform, on jaws, vomer, and palatines; canine teeth often present; no barbels; lower jaw included; vent at throat; gill-membranes somewhat united, free from isthmus; no pseudobranchiæ; no pyloric cæca; vertical fins very low, confluent, without spines; no ventral fins; pectoral fins present or absent.

Small shore-fishes of tropical seas, often living in shells of mollusks, echinoderms, etc., being especially often commensal with the pearl oyster and with the larger *Holothuria*. Only one genus in American waters.

Genus 154. FIERASFER Cuvier.

Gill-membranes little connected, leaving isthmus bare. No distinct caudal fin; pectoral fins developed.

The species of this genus are not well known, and their characters and nomenclatures are uncertain. It is not unlikely that the American species are all reducible to one, *Fierasfer affinis* or *dubius*, but our scanty material will not justify us in taking this view. (Jordan & Evermann.) Only one species known from Porto Rico.

273. Fierasfer bermudensis (Jones). *Pearl-fish.*

Head 8.5 in length; eye 4, longer than snout; mouth large, the maxillary reaching beyond orbit; pectoral 2.5 in head. Teeth small, acute, uniserial, 3 in a line on vomer; palatine teeth small. Color pale-brownish, a bluish streak crossing nape between opercles, 4 pale points on back. Vertebræ 100.

A small fish (length 3 to 6 inches) found in shallow water on coral shores in the West Indies. Two specimens, each about 4 inches long, obtained by us, one at Mayaguez, the other at Puerto Real. They certainly belong to the species described from Bermuda, which may not be different from Günther's *F. affinis* or Putnam's *F. dubius*.

? ? *Fierasfer affinis* Günther, Cat., IV, 381, 1862, no locality given.
? *Fierasfer dubius* Putnam, Proc. Bost. Soc. Nat. Hist. 1874, 344, Pearl Islands.
Lefroyia bermudensis Jones, Zoologist, IX, 1874, 3838, Bermuda.
Fierasfer bermudensis, Jordan & Evermann, l. c., 2497, 1898.

Family LXXIII. PLEURONECTIDÆ. The Flounders.

Body strongly compressed, oval or elliptical in outline; head unsymmetrical, cranium twisted, both eyes being on same side of body, which is horizontal in life, the eyed side being uppermost and colored, the blind side lowermost and usually plain. In the very young fish the bones of the head are symmetrical, 1 eye on each side, and the body is vertical in the water. In most species the cranium becomes twisted, bringing the upper eye over with it. Eyes large, well separated. Mouth small or large, the dentition various, teeth always present; premaxillaries protractile; no supplemental maxillary bone; pseudobranchiæ present. Gills 4, a slit behind the fourth; lower pharyngeals separate; no air-bladder; preopercle with its margin usually distinct, not wholly adnate or hidden by skin of head; vent not far behind head, viscera confined to anterior part of body. Scales various, rarely absent, usually small. Lateral line usually present, extending on caudal fin, sometimes duplicated or wanting. Dorsal fin long, continuous, of soft rays only, beginning on head; anal similar, shorter; caudal various, sometimes coalescent with dorsal and anal; pectorals inserted rather high, rarely wanting; ventrals under pectorals, usually of several soft rays, one of them sometimes wanting.

Fishes mostly carnivorous, inhabiting sandy bottoms in all seas, some species ascending rivers. Many of them are important food-fishes. Genera about 55; species nearly 500.

Subfamilies of Pleuronectidæ.

A. Ventral fins symmetrical, similar in position and in form of base, that of colored side not extended along ridge of abdomen.
a. Mouth nearly symmetrical, dentition nearly equally developed on both sides, gape usually but not always wide. (Halibut tribe.) .... HIPPOGLOSSINÆ
aa. Mouth unsymmetrical, jaws on eyed side with nearly straight outline, bones on blind side strongly curved; teeth chiefly on blind side.
b. Eyes and color on right side (with occasional exceptions). (Flounder tribe.) .... PLEURONECTINÆ
AA. Ventral fins unsymmetrical, dissimilar in position and usually also in form, that of eyed side being extended along ridge of abdomen. Eyes and color on left side. (Turbot tribe.) .... PSETTINÆ

HIPPOGLOSSINÆ. Halibut Tribe.

Large-mouthed flounders with the ventral fins symmetrical.—Mouth symmetrical, the jaws and dentition nearly equally developed on both sides; gape usually wide, maxillary more than one-third length of head. Lower pharyngeals narrow, usually with but 1 or 2 rows of sharp teeth; teeth in jaws usually acute. Eyes large; edge of preopercle free. Pectoral and ventral fins well developed, the ventral fins similar in position and in form of base, that of eyed side not being attached along ridge of abdomen. Septum of gill-cavity without foramen.

The only genera of *Hippoglossinæ* having species ranging as far south on our Atlantic coast as Florida are *Paralichthys*, *Ancylopsetta*, *Notosema*, and *Gastropsetta*. Though no species of this group is known from Porto Rico, we give a key to these 4 genera, as some or all of them may be hereafter found in Porto Rican waters.

a. Dorsal fin beginning in advance of eye; teeth sharp, uniserial or smooth.
b. Scales weakly ciliated; caudal fin with a distinct peduncle; mouth large; teeth unequal, some of anterior canine-like; gillrakers rather long and slender; no dorsal lobe nor produced ventral rays; vertebræ 35 to 41.... PARALICHTHYS
bb. Scales very strongly ctenoid on both sides of body; mouth smallish, with small, sharp teeth; anterior rays of dorsal more or less exserted, thus forming a more or less distinct lobe; gill-membranes considerably united; gillrakers short and broad; caudal peduncle short; left ventral produced; vertebræ (in *A. quadrocellata*) 9 + 26 = 35. Lateral line with its tubes simple, not branched.
c. Body broad, ovate, depth more than half length; dorsal lobe and left ventral moderately produced.... ANCYLOPSETTA
cc. Body elliptical, depth not more than one-half length; dorsal lobe and left ventral greatly produced....... NOTOSEMA
bbb. Scales entirely smooth; caudal peduncle short; mouth small; gillrakers short and thick; dorsal with an anterior lobe; left ventral elongate.................... GASTROPSETTA

PSETTINÆ. Turbot Tribe.

Large-mouthed flounders, with ventral fins unsymmetrical.—Mouth symmetrical, the dentition nearly equally developed on both sides; gape usually wide (narrow in *Platophrys*, *Etropus*, etc.), maxillary commonly more than one-third length of head; lower pharyngeals narrow, each with one or more rows or a narrow band of small, sharp teeth; teeth in jaws acute; eyes not minute; pectorals and ventrals usually well developed; edge of preopercle free; ventral fins dissimilar in form or in position, that of left or eyed side inserted on ridge of abdomen, its base extended along this ridge, its rays more or less wide apart; caudal fin rounded or subtruncate; no accessory lateral line; anal spine usually weak or obsolete; a pelvic spine sometimes developed; vertebræ in moderate or small number, 31 to 45. Body sinistral.

Species chiefly tropical or subtropical in distribution. Of the 10 recognized American genera of this subfamily, 4 have Porto Rican representatives. In fact, all the species of flounders thus far known from Porto Rico belong in this group.

a. Pectoral fin present on each side; septum of gill-cavity below gill-arches without foramen; a deep emargination near isthmus; ventral fins free from anal.
b. Vomer with teeth; lateral line with a strong arch in front; teeth subequal, in villiform bands; body broadly ovate; caudal fin subsessile; interorbital area broad; scales small, cycloid; gillrakers long and slender; anterior dorsal rays produced; vertebræ 36.................... LOPHOPSETTA
bb. Vomer toothless; ventral fins free from anal; caudal fin subsessile.
c. Lateral line with a distinct arch in front; teeth small, uniserial, or imperfectly biserial.
d. Interorbital space more or less broad, deeply concave, at least in males; form broad-ovate; gillrakers short and thick.
e. Scales small, ctenoid, adherent, 75 to 100 or more; anterior rays of dorsal not elevated; pectoral of left side usually filamentous in male; vertebræ (in *P. lunatus*) 9 + 30 = 39.................... PLATOPHRYS, 155
dd. Interorbital space a narrow ridge; dorsal not elevated in front.
f. Gillrakers slender; right ventral elongate; scales ctenoid.................... TRICHOPSETTA
cc. Lateral line without arch in front.
g. Teeth in upper jaw biserial, in lower uniserial, front teeth of upper jaw enlarged; vertebræ 35 or 36; gillrakers short; interorbital space broad in male.................... SYACIUM, 156
gg. Teeth in each jaw uniserial; interorbital space very narrow, ridges coalescing between eyes.
h. Mouth not very small, maxillary more than one-third length of head.
i. Gillrakers very short and thick, tubercle-like.
j. Scales cycloid, small, and firm.................... CYCLOPSETTA
ii. Gillrakers slender, of moderate length; scales thin, deciduous, ciliated; vertebræ 34 to 40.... CITHARICHTHYS, 157
hh. Mouth very small, teeth subequal, maxillary less than one-third length of head; scales thin; teeth uniserial; vertebræ 9 + 25 = 34.................... ETROPUS, 158
aa. Pectoral fin of blind side wanting; eyes very close together; caudal fin subsessile; teeth small, uniserial; mouth moderate; lateral line of eyed side arched, that of right side nearly straight; dorsal fin beginning on snout, its anterior rays not exserted, its rays all simple and very numerous; gillrakers few and feeble; scales small; body thin, very elongate; vertebræ (in *M. sessilicauda*) 43; (deep-sea flounders).... .... MONOLENE

Genus 155. PLATOPHRYS Swainson.

Eyes and color on left side. Body ovate, strongly compressed; mouth of the large type, but comparatively small; maxillary one-third or less length of head; teeth small, subequal, in one or two series; no teeth on vomer or palatines. Interorbital space broad and concave, broadest in adult males. Gillrakers moderate. Dorsal fin beginning in front of eye, all its rays simple; ventral of colored side on ridge of abdomen; caudal convex behind; pectoral of left side with usually one or more filamentous rays, longest in male. Scales very small, ctenoid, adherent; lateral line with a strong arch in front. Coloration usually variegated. The sexual differences are greater than usual among flounders, and the different sexes have often been taken for different species. As a rule, in males, pectoral fin on left side is much prolonged, interorbital area is much widened and very concave, and there are some tubercles about snout and lower eye. The young fishes, as is usually the case, resemble adult females. Lately, Dr. Emery has shown that the larval flounder, known as *Peloria heckeli*, is in all probability the young of *Pleuronectes podas*. The generic name, *Coccolus*, based on forms slightly more mature than those called *Peloria*, probably belongs here also. We have seen no larval forms so young as those which have been described as *Peloria heckeli*. We have, however, examined small transparent flounders, one with eyes quite symmetrical, taken in the Gulf Stream, and another with eyes on left side, taken at Key West. Both these may be larvæ of *Platophrys ocellatus*. The figures published by Emery seem to make it almost certain that the corresponding European forms belong to *P. podas*, although some doubt as to this is expressed by Facciolà.

The species of *Platophrys* are widely distributed through warm seas, no tropical waters being wholly without them; all are extremely closely related and are distinguished with difficulty. On the other hand, variations due to differences of age and sex are greater than in any other of our genera.

Jordan & Evermann recognize 7 American species belonging to this genus. One of these (*P. maculifer*) is shown by our specimens to represent one of the younger stages of *P. lunatus*, and another (*P. ellipticus*) is a stage of the same species. Besides *P. lunatus*, the only other species known to occur in Porto Rico is *P. ocellatus*.

a. Anal rays, at least anteriorly, each with a spinule at base (these formed by a slight widening of tip of interhæmal spines, each being covered by a little rough scale); front of dorsal with similar projections.
b. Color brown, with pale rounded spots; fins dotted with brown; a faint dark spot at first one-third of lateral line; snout with horny points; mouth small, maxillary reaching front of eye.................................. *spinosus*
aa. Anal rays without spinules at their base.
c. Anterior profile of head convex before interorbital area, the very short snout scarcely forming a reentrant angle at its base; form elliptic-ovate, outlines more regular than in *P. lunatus*.
d. Dorsal rays 85 to 95.
e. Scales not very small, about 75 pores in lateral line; no blue markings, at least in young.
f. Mouth smaller, maxillary 3.33 in head. Color light-grayish, tinged with reddish, with small round spots of darker gray, and with lighter rings inclosing spaces of ground-color.. *ocellatus*, 274
cc. Anterior profile of head strongly concave before interorbital area, the projecting snout leaving a marked reentrant angle above it.
g. Mouth not very small; maxillary 3 in head. Color dark-olive, with many rings, curved spots, and small round dots of sky-blue edged with darker on body, these largest near middle of sides, where some are as large as eye; 3 obscure dark blotches on straight part of lateral line... *lunatus*, 275

274. Platophrys ocellatus (Agassiz).

Head 4; depth 1,5; eye (lower) 3.4; snout 5; maxillary 3.33; D. 80; A. 60; scales 75 (pores); vertebræ 37. Body ovate, deep anteriorly, profile descending steeply, snout conspicuously projecting. Mouth very small and oblique, maxillary reaching vertical from the front of lower eye, 3.33 in head; tip of lower jaw entering profile. Teeth fine, conical, in two series in upper jaw, one in lower, those of the outer row in upper jaw larger and more widely separated than those of inner series. Snout very short, equaling interorbital width. Interorbital space narrow, deeply concave, closely scaled. Eyes large, lower in advance of upper; gillrakers obsolete, 7 rudiments on horizontal branch of anterior arch. Scales moderate, not extending on fins, those of colored side ctenoid, on blind side smooth; arch of lateral line short and high. Dorsal fin beginning opposite anterior nostril, rays nearly uniform in length, longest about one-half head; pectoral of colored side 4.75 in length; ventral of colored side beginning under middle of lower eye, with 6 rays; right ventral with 5 rays.

Color in life: Light-grayish, with reddish tinge, covered with small round spots of darker gray and with lighter rings inclosing spaces of ground-color; vertical fins similarly colored, with a small black spot near base of each ninth or tenth ray; 3 black spots on median line of body—one on straightest portion of lateral line just behind arch, another about midway between it, and a third much smaller one at caudal end of body or base of caudal peduncle; some other small black spots scattered over colored side. Eight specimens from Porto Rico present some variation of color; spots on fins not always as in above description, but the general color-pattern is about the same, varying mainly in the darkness or lightness of the shades.

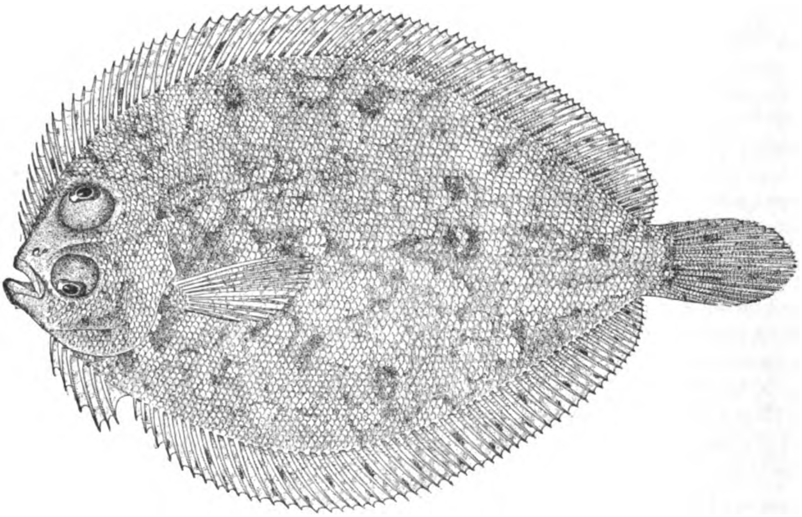

FIG. 105.—*Platophrys occllatus.*

The following shows the variation in some essential measurements of 4 of the largest specimens:

Total length.	Length to base of caudal.	Head in body.	Depth in body.	Eye in head.	Snout in head.	Maxillary in head.	Number of dorsal rays.	Number of anal rays.	Number of pores.
mm.	*mm.*								
73	63	3.7	1.65	3.4	4.85	3.4	80	67	75
71	62	4.13	1.8	3	3.75	3.33	80	60	73
50	42	3.8	1.7	3.14	3.18	3.38	80	59	75
46	40	4	1.8	....	....	....	80	60	75

Found in the western Atlantic from Long Island to Rio Janeiro, on sandy shores. Recorded from several Florida localities and recorded by Poey under other names from Cuba. The present collection contains specimens from San Antonio Bridge, San Juan, Culebra, and Boqueron; Mr. Gray's collection has one from San Geronimo.

Rhombus occllatus Agassiz, in Spix, Pisc. Brasil., 85, pl. 46, 1829, Brazil.
Rhombus bahianus Castlenau, Anim. Nouv. et Rares Amér. du Sud, 1855, Bahia.
Platophrys nebularis Jordan & Gilbert, Proc. U. S. N. M. 1884, 31, 143, Key West.
Platophrys occllatus, Jordan & Evermann, l. c., 2663, 1898.

275. Platophrys lunatus (Linnæus).

Head 3.8; depth about 2; eye (lower) 6.25; interorbital space 3.12; snout (from lower eye) 3.6; maxillary 3.12; pectoral 1.22; D. 92; A. 74; scales (pores) 92. Body elliptical-ovate, strongly compressed; anterior profile concave, snout projecting, leaving a reentrant angle above it; mouth moderate, maxillary reaching to middle of pupil of lower eye; jaws subequal, lower with a well-developed knob at symphysis; teeth small, in an irregular double series in each jaw; anterior end of maxillary with large blunt spine pointing somewhat outward and forward; interorbital very wide and deeply concave; orbital rim, below on upper orbit, above on lower, broken up into blunt papillæ; eye with moderate cirri near upper margin of iris on eye membrane or cover. Gillrakers short and thick, 9 developed on lower part of arch, none on upper. Anterior part of interorbital, snout, maxillary, and mandible naked; scales of eyed side ctenoid, those of blind side smooth; arch of lateral line short and high, its base contained 5.5 in the straight portion. Dorsal fin beginning above the anterior nostril; ventral of colored side beginning under middle of lower eye, with 6 rays; left ventral inserted farther back, also of 6 rays.

Color in spirits: Ground-color of eyed side gray, thickly dotted with light-brown, giving it a brownish tint; speckled with dark-brown, numerous complete, broken, and incomplete rings of light-blue, edged outside with dark-brown or olive, surrounding areas of ground-color; diameter of longest ring about 10 mm., some of the rings with irregular or scalloped outline indicating coalescing spots; base of tail and head with blue spots and crescents; vertical fins and caudal with light-blue spots (becoming white in time); vertical fins brownish with black spots at intervals along the base; pectoral barred with black. A black blotch on lateral line at junction of straight portion and arch, another about midway the straight portion, and another at base of caudal peduncle.

The specimen upon which this description is based (taken from a specimen 213 mm. total length, from Culebra Island) differs somewhat from current descriptions chiefly in lacking the smaller spine on upper edge of maxillary behind larger one on snout; in the filamentous ray of pectoral; in having 6 rays in right ventral; presence of ocular cirri; and in having ctenoid scales on colored side. Notwithstanding these apparent differences, there can be no doubt regarding the identification. The pectoral is slightly filamentous, indicating the possibility of individuals, perhaps the other sex, having the long filament as found in other flat-fishes. The so-called "spine" on the snout is really a tubercle in the above-described specimen, and doubtless is more or less an age or sex character, if not both, and perhaps a more or less individual variation. As shown by other specimens, the scales are not always so strongly ctenoid, and they are not uniformly so in this one. The coloration is plainly that of *P. lunatus*. A series of fishes of this genus shows all grades of coloration and other variations which enable us to include in *P. lunatus* at least one other species formerly considered distinct, and very probably two. *Platophrys maculifer* represents a younger individual of *P. lunatus* in which the supposed differential marks are not so well developed. Jordan & Evermann, in Bulletin 47, U. S. N. M., state that they have never seen any young examples certainly referable to *P. lunatus*, and until its development is traced some of the species known from small examples only must be doubtful. This also leads us to believe that the present conclusions are correct.

The following notes will serve to show something of the color variations:

1. A specimen, 215 mm. long, from Aguadilla has the black blotches along side more diffuse and larger, the first being under end of pectoral below lateral line; cirri are present on both eyes.

2. A specimen from San Antonio Bridge, 131 mm. long, agrees perfectly with descriptions of *P. maculifer* (Poey) in coloration, and very closely in other respects. Head 3.33; depth about 1.8; eye (lower) 5.8; maxillary 3.3; snout 4.12; D. 90; A. 70; scales 86. Mouth small, oblique, the maxillary 3.4 in head; eye with cirri; no filamentous pectoral ray; arch of lateral line short and high. Color, reddish-gray, body covered with circles of round sky-blue spots, which are not confluent and not edged with darker color; besides these very few detached spots or other blue markings; head with similar blue spots, but no rings; area inclosed in blue rings not different from ground-color; caudal with blue spots, other fins with none; dorsal and anal mottled with black blotches each covering the bases of about 3 rays, with about 7 rays intervening between the blotches; a large, diffuse, dusky spot at front of straight part of lateral line; one better defined with lighter area on it anteriorly on middle of lateral line; a faint one under last part of vertical fins not far in front of caudal peduncle; pectoral grayish, with narrow dark bars.

3. A specimen 97 mm. long from Playa de Ponce may be described as follows: Head 3.5; depth about 1.7; eye about 4.33; snout 4; maxillary 3; D. 85; A. 73; pores 90; ocular cirri present. Color, gray, clouded with smoky-brown and some still more dusky mottlings; numerous small blue spots arranged in more or less complete rings and singly, some of the rings with a small whiter spot in center; large black blotch just behind arch of lateral line, one midway of straight portion, and another small faint one over last part of anal fin; first blotch has 4 gray areas in it, second has one large crescentic gray area, which is spotted or dotted with black; a fainter, lighter margin around front of point of the

most intense part of blotch, giving it an ocellated effect. Small ocelli, similar in character, scattered over body; fins all spotted and marked with black.

4. A specimen, 109 mm. total length, presents similar color pattern to the preceding, but of lighter shade. Head 3.8; depth 1.8; eye 4.16; snout 3.8; maxillary 2.7; D. 91; A. 70; scales (pores) 90; cirri present on eye membranes.

5. A specimen, 42 mm. long, possesses about the same general color arrangement as larger specimens, but lacks the blue spots. Head 3.33; depth 1.8; D. 94; A. 72; pores 87. Ocular cirri large.

6. Another young individual from Ponce, 45 mm. in total length, is very brightly and distinctly marked in the same general way as the others mentioned, but lacks the blue spots. Ocular cirri large. Head 3.33; depth 1.33; D. 94; A. 69; pores 82.

7. A young example from San Antonio Bridge, 50 mm. long, presents the same general appearance as the other young ones, but has longer ocular cirri. Head 3.5; depth 1.75; eye 4.8; snout 4; maxillary 3; pectoral 1.5; D. 96; A. 73; pores 83.

Life color: Pale-sandy, with numerous small ocellated brown spots with pale centers; a large black blotch on lateral line at posterior third of body; fins with numerous small white spots and a few larger irregular brown ones.

An inhabitant of the West Indies, north to Florida; common; recorded from Havana, Cienfuegos, Jamaica, Bahamas, Sombrero, St. Thomas, and from Green Turtle Key. Specimens at hand from Culebra, Aguadilla, San Antonio Bridge, San Juan, and Ponce, Porto Rico.

Solea lunata et punctata (the Sole), Catesby, Nat. Hist. Carolina, tab. 27, 1725, Bahamas.
Pleuronectes lunatus Linnæus, Syst. Nat., ed. X, 269, 1758, Bahamas; based on Catesby.
Pleuronectes argus Bloch, Ichth., tab. 48, 1783, Martinique; after Plumier.
?*Pleuronectes surinamensis* Bloch & Schneider, Syst. Ichth., 156, 1801, Surinam.
Pleuronectes maculiferus Poey, Memorias, II, 316, 1860, Cienfuegos, Cuba.
Pleuronectes ellipticus Poey, Memorias, II, 315, 1860, Cuba.
Platophrys lunatus, Jordan & Evermann, l. c., 2665, 1898.
Platophrys maculifer, Jordan & Evermann, l. c., 2664, 1898.
Platophrys ellipticus, Jordan & Evermann, l. c., 2665, 1898.

Genus 156. SYACIUM Ranzani.

Body elliptic-ovate, much compressed; interorbital space broad in males and more or less concave, narrowed in female; mouth moderate, gape curved; teeth in upper jaw biserial, in lower uniserial; front teeth of upper jaw enlarged; vomer toothless; scales rather large, ciliate; lateral line without arch in front; pectoral fins present on both sides; septum of gill-cavity below gill-arches without foramen; a deep emargination near isthmus; gillrakers short and thick; dorsal low, its anterior rays not elevated; pectorals both present; caudal subsessile; no anal spine; pectorals produced in males; ventral fins short, that of colored side on ridge of abdomen.

This genus contains a considerable number of species, mostly American and African, which form a transition from *Platophrys* to *Citharichthys*. They fall readily into 2 groups distinguished by width of interorbital space. As this width is dependent on age, and as it is subject to various intergradations, the group *Aramaca* founded on it can not be admitted as a distinct genus.

a. Snout and orbits without spines or spinous processes.
b. Scales rather large, 50 to 57 in lateral line; interorbital space broad. Color, nearly plain brown, with darker dots or mottlings, no ring-like spots or ocelli; fins mottled; left pectoral barred; blind side sometimes wholly or partly dusky, especially in northern specimens.......... *patulum*
bb. Scales rather small, 58 to 70 in lateral line.......... *micrurum*, 276

276. Syacium micrurum Ranzani.

Head 3.8 in length; depth 2.4; D. 87 to 92; A. 54 to 68; scales 65 to 70 (pores); eye 4 in head; maxillary 2.5 to 3. Form regularly elliptical, profile evenly convex to end of snout; eyes large, nearly even in front, male with interorbital space deeply concave, its width two-thirds vertical depth of eye (or more in Brazilian specimens); female with interorbital area much narrower, with a more or less perfect median groove, its width about equal to depth of pupil; mouth small, maxillary reaching to below middle of eye; teeth small, slender, in 2 rows above, in 1 row below, outer series in upper jaw somewhat enlarged, but hardly canine-like; gillrakers very short and thick, about 1 + 7 in number; scales small, firm, moderately ctenoid; pectoral 1.33 in head in female, reaching nearly to base of caudal in male; vertebræ 9 + 24 = 33.

Color, dark-brown, with many rings and spots of light-gray and blackish, some of the dark rings with a black central spot; a diffuse dusky blotch on lateral line above pectoral and one near base of caudal peduncle; fins with numerous inky spots and dark markings; blind side pale.

Fifteen specimens from Mayaguez appear to differ somewhat in general appearance from other specimens which can be referred to this species, but measurements and comparison reveal no really tangible constant differences. The largest, 163 millimeters long, presents the following characters: Head 3.9; depth 1.33; eye 4.5; snout 4.8; maxillary 2.4; interorbital 8; pectoral 1.3; D. 88; A. 68; scales 59 (68). Color, plain-brown, with a few faint or obscure grayish ocelli and darker spots; a faint brown blotch under end of pectoral, 1 on middle of straight line and 1 near base of caudal peduncle. All fins with light-brown crossbars.

For comparison measurements of an undoubted *S. micrurum* of similar size are given: Head 3.75; depth 2.4; eye 5.33; snout 4.8; maxillary 2.6; interorbital 16; pectoral 1.4; D. 88; A. 70; scales 59 (65).

West Indian fauna, Key West to Rio Janeiro, Cuba, Haiti, Jamaica, and Bahia, rather common; the Porto Rican examples are from Mayaguez, Ponce, Hucares, Aguadilla, Culebra, Boqueron, Palo Seco, and stations 6059 and 6061.

Syacium micrurum Ranzani, Nov. Spec. Pisc. Diss., Sec., 20, pl. 5, 1840, Brazil; Jordan & Evermann, l. c., 2672, 1898.
Hippoglossus ocellatus Poey, Memorias, II, 314, 1860, Cuba.
Hemirhombus aramaca Günther, Cat., IV, 42, 1862, Cuba and Jamaica.
Citharichthys æthalion Jordan, Proc. U. S. N. M. 1886, 52, Havana.

Genus 157. CITHARICHTHYS Bleeker. Whiffs.

Eyes and color on left side. Body oblong; mouth of the large type, but comparatively small, with 1 series of small, sharp teeth in each jaw; no teeth on vomer or palatines. Gillrakers moderate, slender. Dorsal fin beginning just in front of eye; all fin rays simple; ventrals of colored side on ridge of abdomen; no anal spine; caudal fin convex or double truncate behind, none of the fins produced. Scales thin, deciduous, slightly ctenoid. Lateral line nearly straight, simple. Lower pharyngeals separate, each with a single row of teeth. Vertebræ 30 to 40.

This genus includes small flounders of weak organization, especially characteristic of sandy shores of tropical America. The sub-genus *Orthopsetta* includes species of more northern range and somewhat different form, and especially noteworthy as having an increased number of vertebræ. The two groups intergrade so perfectly that no sharp line of division can be drawn between them.

The genus *Citharichthys* contains 13 American species, 7 of which are Atlantic. Only 3 of these are known to occur in Porto Rico.

a. Vertebræ 33 to 36; interorbital ridge low and narrow, head closely compressed.
b. Eye large, 3 to 4.5 in head.
c. Head large, 3 to 3.33 in length.
d. Interorbital space very narrow, 5 in eye; snout with a spine; pectoral of eyed side elongate, one-third longer than head; maxillary 2.25 in head. D. 91; A. 73; scales 48 .... *dinoceros*
cc. Head smaller, about 4 in length.
e. Body comparatively elongate, depth about 2.5 in length; mouth very small; maxillary 3.5 in head; dorsal rays 83; anal 67; scales 40; eye 4 in head .... *arctifrons*
ee. Body comparatively broad, depth about half the length; mouth larger.
f. Snout with a strong, sharp spine on eyed side, above upper lip; eye large, 2.3 to 3 in head; greatest depth of body over pectorals; interorbital space with a wide ridge, about half diameter of eye .... *unicornis*, 277
ff. Snout without distinct spine; eye moderate, 3.5 to 4.5 in head; greatest depth of body under middle of dorsal; interorbital space a narrow, scaly ridge with a slight median groove; maxillary 2.33 in head; teeth small, those in front slightly enlarged; body not very thin; gillrakers moderate, 6+13.
g. Dorsal rays 68; anal 52; scales smaller, lateral line with about 53 pores; side with whitish blotches .... *uhleri*
gg. Dorsal rays 80; anal 56; scales large, 41 in lateral line; side and fins with dark blotches .... *macrops*
bb. Eye quite small, 5 to 8 in head; snout short, forming an angle with profile; mouth moderate, oblique, maxillary 2.5 to 2.66 in head; teeth small, anterior somewhat enlarged; dorsal about 80; anal 60; body and fins speckled.
h. Scales not very large, 45 to 51 in lateral line; gillrakers long and slender, longer than pupil.
i. Eye small, about 8 in head .... *spilopterus*, 278
ii. Eye larger, about 6 in head .... *arenaceus*, 279

277. Citharichthys unicornis Goode.

Head 4.5; depth 2.33; eye 2.33; snout 4; maxillary 2.33; pectoral 1.55; D. 77; A. 60; scales 42. Body ovoidal, not particularly deep, but strongly compressed; head broad across front; mouth moderate; no spines, but a knob at symphysis of lower jaw; eye large; interorbital a narrow ridge dividing anteriorly, becoming front rim of orbit, concave in front of eyes; pectoral short; longest rays of vertical fins moderate; scales large, deciduous.

Color, somewhat mottled light-brown.

This description is from a single specimen taken by the *Fish Hawk* at station 6063, in Mayaguez Harbor. Total length 57 mm., the only specimen of this species taken. After comparison with a large number of specimens in the U. S. National Museum, we have decided that the present specimen is a female, the lack of spines on head being coincident with a narrow interorbital. Our example corresponds exactly with many females of similar size in the National Museum collection. The wide interorbital in other species has been found associated constantly with the male when any difference of this kind existed. For comparison, and because the horned fish may be met with, a description of an individual, presumably a male, taken in deep water in the Gulf Stream, is here given: Total length 77 mm.; head 3.5; depth 2.25; eye 3; interorbital 6; snout 4.5; maxillary 2.25; pectoral 2.15; D. 74; A. 60; scales 45. Head broad, wider across front of eyes than in female; muzzle less sharp; interorbital wide anteriorly, narrowing behind, concave, a ridge extending across from back part of upper orbit to side of anterior orbit in front (in the female this makes the ridge between the eyes); a sharp slender spine projecting forward from edge of upper part of the snout; 2 smaller ones from point of upper orbit; small one from side of snout near tip extending somewhat to one side; 2 from front of orbital rim or lower eye; knob at symphysis of lower jaw; head, as in the female, everywhere scaled. Fins evidently once had brown blotches.

Formerly collected in deep water of Gulf Stream off southeast coast of New England; off Sand Key, Florida, in 44 fathoms; and in the Gulf of Mexico southward of Cape San Blas, in 60, 111, and 142 fathoms.

Citharichthys unicornis Goode, Proc. U. S. N. M. 1880, 342, Gulf Stream southeast of New England; Jordan & Evermann, l. c., 2683, 1898.

278. Citharichthys spilopterus Günther.

Head about 3.75; depth about 2.25; eye 7.8; snout 5.8; maxillary 2.5; pectoral 2; D. 82; A. 61; scales (pores) 48. Body moderately elongate, much compressed; snout short, forming an angle with profile; jaws strongly curved, upper somewhat hooked over lower; lower jaw slightly included; maxillary reaching to posterior margin of lower orbit; teeth small, in a single row, anterior a little enlarged; interorbital area a low, narrow ridge, which is divided anteriorly; gillrakers short and rather slender; scales finely ctenoid on colored side; origin of dorsal above anterior edge of upper eye, slightly on blind side; origin of anal slightly behind base of pectoral.

Color, light-brown mottled somewhat with darker; indistinct blotch on lateral line under tip of pectoral, one about middle of straight portion, and one at base of caudal; vertical fins with narrow elongate spots on rays vertically arranged, sometimes in pairs at more or less regular intervals.

Description taken from specimen, 148 mm. total length, from Mayaguez. Everywhere abundant on sandy shores of the warmer parts of western Atlantic, in shallow water; specimens recorded from South Carolina, Florida, Cuba, and Brazil. The Porto Rican collection contains numerous individuals from Mayaguez, Aguadilla, San Antonio Bridge, San Juan, Playa de Ponce, Palo Seco, Vieques, Caballo Blanco Reef, Puerto Real, Boqueron, and Fajardo.

Citharichthys spilopterus Günther, Cat., IV, 421, 1862, New Orleans, Santo Domingo, and Jamaica; Jordan & Evermann l. c., 2685, 1898.

Citharichthys cayannensis Bleeker, Comptes Rendus Acad. Sci. Amsterdam, XIII, 1862, 6, Cayenne; name only.

Citharichthys guatemalensis Bleeker, Neder. Tydschr. Dierk., 1864, 73, Guatemala.

279. Citharichthys arenaceus Evermann & Marsh, new species.

Head 3.8; depth nearly 2; eye 6; snout 5; maxillary 2.2; pectoral 1.8; D. 74; A. 54; pores 51. Body elliptical, rather deep; head deep; mouth large; snout not very prominent, making but a slight notch in front of upper eye; interorbital narrow, concave; eyes small, not close together; lateral line not arched, but from upper end of gill-opening directed slightly downward to about in a line with tip of pectoral, whence it extends directly backward to caudal fin; scales of colored side (left) finely ctenoid, with accessory scales along region of lateral line; rays of vertical fins and caudal with small scales, as is usual in flat-fishes; ventrals with 6 rays each.

Color light-gray, thickly spotted with olive, giving it a granitic appearance, the rays of all the fins with narrow alternating olive and gray crossbars; some rays of vertical fins with short oblong spots extending in the direction of the ray; blind side pale.

A small-eyed *Citharichthys*, in this respect related to *C. spilopterus*, but, except in small examples, bearing scarcely any other resemblance to that species. It differs from *C. spilopterus* mainly in the general heavier appearance, being everywhere broader and thicker, and in its color. There are two unnamed specimens in the National Museum from Santo Domingo referable to this species, otherwise known only from Porto Rico. This description is from a specimen, 162 mm. in total length (type No. 49526, U. S. N. M.), 1 of 10 specimens from Mayaguez.

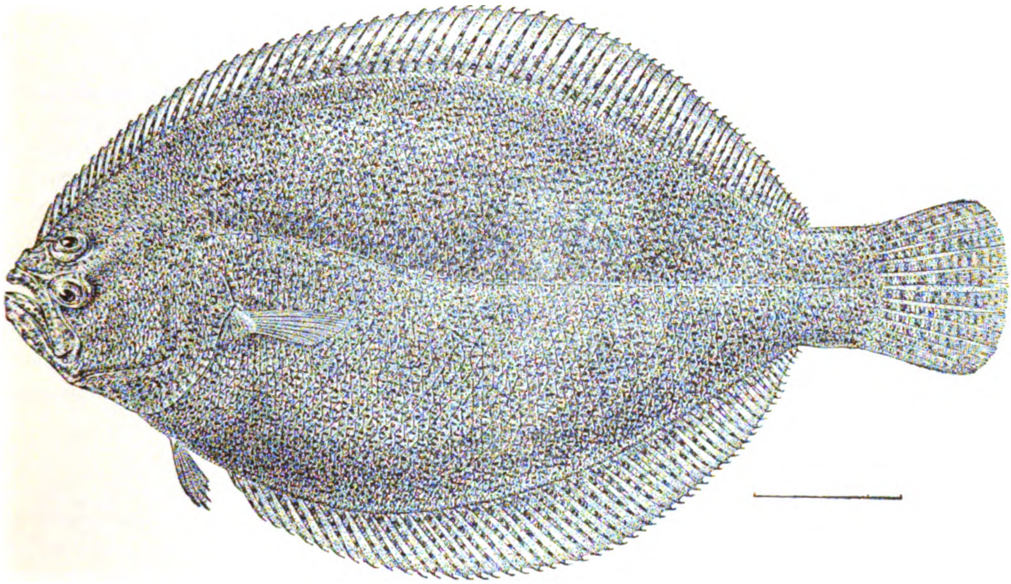

FIG. 106.—*Citharichthys arenaceus.*

The following table of relative measurements of these specimens is given for comparison:

Comparative measurements of 10 cotypes of Citharichthys arenaceus.

No.	Total length.	Length to base of caudal.	Head.	Depth.	Eye.	Snout.	Maxillary.	Pectoral.	Dorsal.	Anal.	Pores.
1	162*	141	3.8	2	6.17	5.3	2.33	1.5	74	54	50
2	130	110	3.75	2	5.8	4.8	2.41	2.07	68	50	54
3	114	100	3.84	2.8	5.2	4.33	2.6	1.86	69	51	45
4	94	81	4.05	2.14	5	5	2.5	2	70	50	48
5	95	82	3.86	2.1	5.25	4.66	2.33	2.1	70	53	48
6	95	81	3.86	2.011	5.25	5.25	2.62	2.1	75	48	50
7	88	76	4	2.17	4.75	4.75	2.7	1.9	74	54	50
8	84	73	3.94	2.14	5.3	5.3	2.5	2.05	75	53	49
9	77	65	3.8	2.17	4.86	4.86	2.43	2.12	72	51	48
10	59	49	3.8	2.33	4.33	4.33	2.6	1.86	72	51	48

*The type.

One other specimen was collected January 19 at Mayaguez, 2 at Aguadilla January 18, and 1 at San Juan January 14. The two from Aguadilla may be described as follows:

Measurements.	No. 1.	No. 2.
Total length	125	123
Length to base of caudal	115	116
Head (about)	4	4.14
Depth (about)	2.16	2.33
Eye (about)	5.8	6.22
Snout (about)	5.25	5.9
Maxillary	2.63	2.54
Pectoral	2.25	2.17
Dorsal	73	72
Anal	52	51
Pores	46	50

Color of same general pattern, but with large brownish blotches over body and one on caudal peduncle.

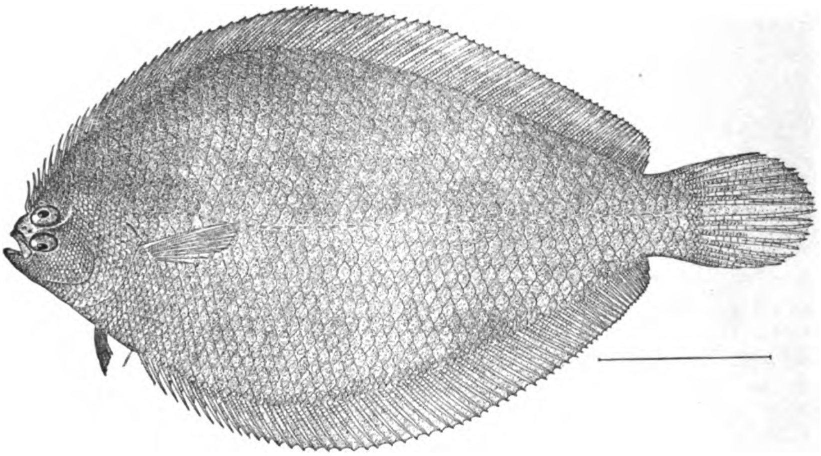

FIG. 107.—*Etropus crossotus.*

Genus 158. ETROPUS Jordan & Gilbert.

Eyes and color on left side. Body regularly oval, deep, and compressed. Head small; mouth very small, teeth close-set, slender, and pointed, somewhat incurved, mostly on blind side; no teeth on vomer. Eyes small, separated by a narrow, scaleless ridge; margin of preopercle free. Ventrals free from anal, that of colored side inserted on ridge of abdomen, its base rather long. Dorsal fin beginning above eye; caudal double-truncate; anal without spine. Scales thin, deciduous, ctenoid on left side, cycloid on blind side. Lateral line simple, nearly straight.

This genus is very close to *Citharichthys*, from which it differs only in the very small size of mouth and in the correspondingly weak dentition. The 3 or 4 known species are similar in appearance to the species of *Citharichthys* and inhabit the same waters. Size small. *Thysanopsetta*, a South American genus, is also very close to *Etropus* and *Citharichthys*, but has teeth arranged in a band. The larval forms are translucent and symmetrical, as in *Platophrys*, *Monolene*, *Arnoglossus*, etc.

a. Snout not acute; dorsal rays 75 to 85.
b. Body comparatively elongate, depth rather less than one-half length.
c. Dorsal rays 81; anal 58; head 4.25 in length; eye 3.5 in head; maxillary 4 .... *microstomus*
cc. Dorsal rays 77; anal 61; head 4 in length; eye 3.5 in head; maxillary 4.33 .... *rimosus*
bb. Body very deep, depth more than one-half length; eye 3.75 in head; maxillary 4; head 4.8; depth 1.8 to 2; D. 76 to 85; A. 56 to 67; scales 42 to 48; cirri on subopercle of blind side very numerous, white; olive ground, with darker blotches; fins sanded .... *crossotus*, 280

280. **Etropus crossotus** Jordan & Gilbert.

Head 4.8 in length; depth 1.75 to 2; D. 76 to 85; A. 56 to 67; V. 6; scales 42 to 48; vertebræ 9 + 25 = 34. Body oval and strongly compressed, with the dorsal and ventral curves nearly equal; both outlines strongly arched anteriorly, body much deeper in the adult; head very small; snout short; mouth very small, its cleft not so long as diameter of orbit; teeth conical, pointed, close-set, strongly incurved, in a single series, those in upper jaw on the blind side only, those on lower jaw on both sides; eyes large, lower in advance of upper, separated by a very narrow scaleless ridge, which extends backward above the preopercle; edge of opercle on blind side with a row of conspicuous white cilia; upper nostril turned somewhat to blind side; anterior nostril on left side, with a very slender cirrus; dorsal fin commencing over front of upper eye, its middle rays highest, anterior not elevated; anal fin not preceded by a spine, its middle rays highest; caudal fin very sharply double-truncate, as long as head; pectorals short, that of left side the longer, about three-fourths length of head; ventral of colored side on ridge of abdomen, the membrane of its last rays nearly reaching base of first ray of anal; ventral of blind side longer than the other, one-half length of head, inserted farther forward than that of colored side; vent lateral, with well-developed anal papilla. Scales thin, large, ctenoid on colored side, smooth on blind side, those on middle part of body larger; head entirely scaly, except the snout and interorbital ridge; rays of vertical fins with scales on basal half, on colored side; lateral line developed equally on both sides, nearly straight.

Color, olive-brown, with some darker blotches, most distinct in larger specimens; vertical fins finely mottled and streaked with black and gray; pectoral and ventral on left side spotted.

Tropical America on both coasts, north to Cerros Island and North Carolina, south to Panama and Rio Janeiro; recorded from Charleston, Cedar Keys, New Orleans, Galveston, Beaufort, N. C., Mazatlan, Panama, from localities along both sides of coast of Lower California, and from several places in Florida. Specimens before us are from Mayaguez, Palo Seco, and Arroyo, Porto Rico.

Etropus crossotus Jordan & Gilbert, Proc. U. S. N. M. 1881, 364, Mazatlan; Jordan & Evermann, l. c., 2689, 1898.

Family LXXIV. SOLEIDÆ. The Soles.

Body oblong or elongate, usually scaly; mouth very small, much twisted toward eyed side; teeth in villiform bands, very small or obsolete; eyes small, close together, with or without a bony ridge between them; edge of preopercle adnate, concealed by skin and scales; gill-openings narrow, gill-membranes adnate to shoulder-girdle above; pectoral fins small or wanting; ventral fins small, one or both sometimes wanting.

Small fishes living on sandy bottoms, similar to the *Pleuronectidæ* in structure, but much degraded, the fins and teeth having lost many distinctive qualities; the vertebræ usually in increased numbers.

The soles are numerous in the warm seas, and those of sufficient size are valued as food. They comprise about 12 genera and 150 species. They are naturally divisible into 3 subfamilies, each quite distinct from the others, and possibly independently descended or degraded from normal *Pleuronectidæ*. The North American species belong to 2 subfamilies, very different one from the other. The *Achirinæ*, or American soles, are apparently allied to the *Psettinæ*, the ventral fin of eyed side extending along ridge of abdomen. The *Soleinæ*, or European soles, show in the insertion of ventral and in other respects a strong resemblance to the *Pleuronectinæ*. The more aberrant *Cynoglossinæ*, or tongue-fishes, are perhaps degraded *Soleinæ*, but the eyes are sinistral, as in the *Psettinæ*. In the *Soleinæ* and *Achirinæ* the eyes are dextral, as in the *Pleuronectinæ*.

ACHIRINÆ:

I. Soles with eyes on right side and separated by a distinct bony ridge; ventral with long base confluent with anal. Body oblong or ovate, with color on right side; eyes moderate or small, upper eye usually more or less in advance of lower; mouth small, more or less twisted toward blind side; teeth little developed, in villiform bands; edge of opercle adnate, usually concealed by scales; gill-openings more or less narrowed, gill-membranes adnate to shoulder-girdle above; blind side of head usually with fringes; pectoral fins small, sometimes wanting; ventral fins developed, one or both of them sometimes obsolete; scales usually ctenoid, rarely wanting; lateral line straight, usually single; right ventral with extended base, confluent with anal fin.

a. Gill-openings of moderate extent, confluent below; vertical fins well separated; body ovate in outline, depth nearly one-half length; pectoral fins rudimentary or wanting; lateral line straight; scales well developed, ctenoid more or less enlarged on head, those of blind side of head with fringes; vertebræ about 28........ ACHIRUS, 159

aa. Gill-openings very small, separate, each reduced to a small slit below angle of opercle; right ventral beginning at chin; pectoral fins minute or wanting; lateral line straight; snout dilated, dorsal beginning upon it.

b. Scales present, ctenoid; caudal somewhat confluent with dorsal.
c. Left ventral rudimentary, with 2 rays .... APIONICHTHYS
bb. Scales none; caudal free from dorsal and anal .... GYMNACHIRUS

CYNOGLOSSINÆ:
II. Soles with eyes on left side, not separated by a bony ridge. Body elongate, more or less lanceolate in outline, with color on left side.
d. Ventral fin of eyed side only present, free from anal; no pectoral fins; no lateral line; head without fringes. .... SYMPHURUS, 160

Genus 159. ACHIRUS Lacépède. American Soles.

Eyes and color on the right side. Body oblong, bluntly rounded anteriorly. Head small; eyes small, close together, upper eye in advance of lower, the two separated by a bony ridge; mouth small, somewhat turned toward colored side; nasal flaps present, nostril of blind side fringed; lip of colored side fringed; teeth very small, on blind side only; gill-openings rather narrow, but confluent below, not reduced to a slit; branchiostegal region scaled. Head closely scaled everywhere, scales on colored side similar to those on body, those of nape and chin much enlarged; scales on blind side anteriorly with their pectinations more or less produced, forming cirri; scales of both sides extremely rough, extending on fins. Lateral line straight, simple; edge of preopercle covered by scales. Dorsal beginning on snout, low in front and thickly scaled, its rays divided; anal fin similar, without spine; caudal fin free, convex; caudal peduncle very short and deep; pectoral fin of left side wanting, that of right side small or obsolete; ventral rays 3 or 4, ventral fin of colored side long, connected with anal by a membrane.

This strongly marked genus contains numerous species, all very closely related, and nearly all American. It has been united by Dr. Günther with *Solea*, but for no good reason, as the number of vertebræ is very much fewer than in the European soles, and the right ventral fin is decurrent along the abdomen and united with the anal in the American soles, while it is short and wholly free in all the European forms. The two groups belong in fact to distinct subfamilies. It is also worth noticing that the name *Achirus* is prior in date to that of *Solea*. The species with rudimentary pectoral fins have been set apart by Dr. Bean to form the genus *Baiostoma*, but the very slight development of these organs in some of the species and the evidently very close relationship of them all lead us to regard *Baiostoma* as a subgenus only. If we follow Kaup in restricting the name *Achirus* to the Asiatic group called *Pardachirus*, the present genus would receive the name of *Trinectes*. It seems to us, however, that both Lacépède and Cuvier regarded the species called by us *A. fasciatus* as the type of their genus *Achirus*.

BAIOSTOMA:
a. Pectoral fins small, present at least on right side.
b. Pectoral fins present on both sides, that of left side rudimentary, of a single ray; of eyed side with about 3 rays.
c. Dorsal rays 60 to 67; anal rays about 48. Color brownish, irregularly spotted with darker, and with about 10 black vertical lines crossing lateral line .... *achirus*
cc. Dorsal rays 53 to 57. Color olivaceous .... *inscriptus*, 281
bb. Pectoral of right side only present.
d. Dorsal rays 50 to 58; anal rays 38 to 48.
e. Pectoral fin of 4 to 6 rays, considerably longer than eye; body with 8 to 10 narrow, vertical dark bars, these sometimes obsolete with age .... *lineatus*, 282

ACHIRUS:
aa. Pectoral fins wholly wanting; dorsal rays 50 to 55; anal rays 37 to 46; right lower lip fringed; left nostril with some fringes; depth 1.8 in length; head 4; none of scales of eyed side with hair-like appendages. Color dusky-olive, more or less mottled with about 8 dark vertical stripes, these varying very much in width and number; caudal spotted .... *fasciatus*

281. Achirus inscriptus Gosse.

Head 3.75 in body; depth 1.75; D. 53 to 57; A. 40; scales 75 to 80; interorbital width less than eye; upper eye in advance of lower. Pectoral present on each side, that of left side rudimentary, usually of a single ray; that of eyed side with about 3; left ventral with 1 or 2 small rays, in some specimens entirely absent; right ventral joined to anal. Scales smaller and less rough than usual in this genus, those of nape scarcely enlarged on eyed side, those of blind side much fringed; scales of colored side with scattered hair-like appendages, some black, others pale. Vertebræ $8 + 20 = 28$.

Color, olivaceous; head, body, dorsal, and anal fins covered with a network of dark lines; traces of about 8 dark cross-streaks sometimes present; caudal base dusky. One specimen, 46 mm. long, from Palo Seco, has the color rather darker than usual, dark network so distinct that lighter ground-color shows as distinct light-gray spots; large round black spots scattered over side and vertical fins; no cross-streaks; caudal very pale with but a trace of dusky markings. Another individual, from San Antonio

Bridge, is very darkly colored, due to intensity of black network and darker gray ground-color; blind side somewhat dusted over with brown specks, which grade into solid blue-black on caudal peduncle; caudal fin abruptly pale with few faint dusky dots; vertical fins very dark on blind side, rays paler.

A specimen, 77 mm. long, from Aguadilla possesses 3 rays in each pectoral fin and is the only one of the collection having cross-streaks, of which there are about 8.

An inhabitant of the West Indies, north to southern Florida. It has been recorded from Haiti, Key West, and Cape Florida. This collection contains specimens from station 6063 (in Mayaguez Harbor in 75 fathoms), Fajardo, Palo Seco, Aguadilla, San Antonio Bridge, and San Juan.

Achirus inscriptus Gosse, Nat. Sojourn Jamaica, 52, pl. 1, fig. 4, 1851, Jamaica; Jordan & Evermann, l. c., 2696, 1898.
Monochir reticulatus Poey, Memorias, II, 317, 1861, Cuba.

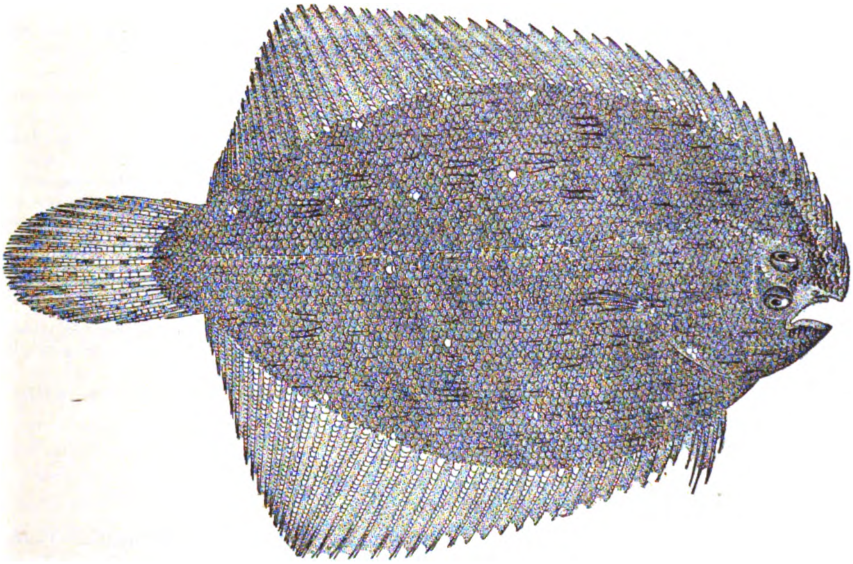

FIG. 108.—*Achirus lineatus.*

282. **Achirus lineatus** (Linnæus).

Head 3.5; depth about 1.5; D. 49 to 58; A. 38 to 44; scales 75 to 85. Pectoral fin of right side only developed, of 4 to 6 rays, considerably longer than eye. Body with 8 to 10 narrow, vertical dark bars, these sometimes obsolete with age; vertical fins all with round dark spots, these usually especially distinct on caudal fin; some of scales of eyed side with black, hair-like appendages; pectoral fin with 5 or 6 rays, about 3 in head, its length equal to distance from outer edge of one eye to outer edge of other.

Color, brown, the young spotted with whitish, the adults sometimes with darker; body with about 8 narrow, vertical cross-streaks of blackish.

West Indies and Brazil, Florida Keys to Uruguay; common and variable. Recorded from Jamaica and Cienfuegos in the West Indies and from both coasts of Florida. Specimens at hand are from San Juan market. Palo Seco, Boqueron, and Vieques, Porto Rico.

Passer lineis transversis notatus Sloane, Jamaica, 2, 77, pl. 246, fig. 2, 1725, Jamaica.
Pleuronectes fuscus subrotundus glaber Browne, Jamaica, 445, 1756, Jamaica.
Pleuronectes lineatus Linnæus, Syst. Nat., ed. X, 268, 1758, Jamaica; based on Browne and Sloane; not of ed. XII, which is *Achirus fasciatus.*
Monochir maculipinnis Agassiz, Spix, Pisc. Brasil., 88, pl. 49, 1829, Brazil; Poey, Fauna Puerto-Riqueña, 341, 1881; Stahl, l. c., 166, 1883.
Baiostoma brachialis Bean, Proc. U. S. N. M. 1882, 413, Apalachicola Bay and south Florida.
Achirus comifer Jordan & Gilbert, Proc. U. S. N. M. 1884, 31, Key West.
Achirus lineatus, Jordan & Evermann, l. c., 2698, 1898.

Genus 160. SYMPHURUS Rafinesque. Tongue-fishes.

Body elongate, more or less lanceolate in outline, with eyes and color on left side; eyes small, very close together, with no distinct interorbital ridge between them; mouth small, twisted toward blind side; teeth little developed, in villiform bands; edge of preopercle covered by scales; gill-openings narrow, gill-membranes adnate to shoulder-girdle above, joined together and free from isthmus below; pectoral fins wanting (in adult); vertical fins more or less confluent; scales ctenoid; lateral line wanting. Ventral fin of eyed side only present, free from anal; head without fringes.

SYMPHURUS:
a. Scales not minute, ctenoid, 65 to 105 in number; dorsal rays 86 to 100; anal rays 70 to 87.
b. Scales rather large, about 65; head 4.33; depth 4.33; color, clouded-brown .... *piger*
bb. Scales small, moderately ctenoid, 75 to 105 in a longitudinal series.
c. Dorsal and anal pale anteriorly, becoming more or less abruptly black posteriorly.
d. Caudal fin abruptly pale, at least at tip.
e. Body elongate, depth 4.5 in length; head 5.5. D. 96 to 100; A. 86 or 87; scales 88 to 90. Color, grayish, speckled with brown; dorsal and anal fins black on last tenth; caudal abruptly pale; tips of fin rays vermilion... *marginatus*
dd. Caudal fin black, as is a large part of dorsal and anal, black either continuous or in form of large spots. Color, brownish, often mottled, usually with more or less distinct darker crossbands and with longitudinal streaks along rows of scales, sometimes nearly plain brown.
f. Scales rather larger, 75 to 90. Body less elongate, depth 3.1 to 3.66 in length; head 5.25 to 5.75. Dorsal 88 to 95; anal 75 to 80 .... *plagusia*, 283
cc. Dorsal and anal pale throughout, or more or less mottled or spotted with darker, caudal similarly colored, not distinctly black. Body not very elongate, depth 3 to 3.33 in length. (Probably all varieties of *S. plagiusa.*)
g. Body with dark crossbands more or less distinct; fins mottled or speckled; upper eye slightly in advance of lower.
h. Dorsal rays 86 to 95; anal rays 75 to 80; head 5 in length; depth 3.25; scales 85 to 93; crossbands more distinct than in related species.. *plagiusa*
hh. Dorsal rays 78 to 85; anal rays 70 to 72; head 5 in length; depth 3.5; scales 80 to 90. Color, light-brown, with darker crossbars, which become obsolete with age.. *pusillus*
gg. Body uniform grayish, without crossbands; last part of dorsal and anal with 3 or 4 oblong black blotches; each somewhat larger than eye; upper eye directly above lower; head 5.66 in length. Scales 85; D. 92; A. 75.. *diomedeanus*
ACEDIA:
aa. Scales very small, ctenoid, each with a medium dark streak, which simulates a keel, but is not a ridge; snout and jaws naked; fin rays in increased number.
i. Head 5.66; depth 4.66; D. 119; A. 107; scales 120. Grayish, everywhere mottled with brown .... *nebulosus*

283. **Symphurus plagusia** Bloch & Schneider. *Tongue-fish.*

Head 5.25; depth about 3.5; D. 88; A. 76; scales 90. Body rather elongate. Color, brown, somewhat clouded; narrow longitudinal lines along rows of scales, posterior part of dorsal and anal and caudal black; dark bars on dorsal and anal in direction of rays. The black caudal has been considered the mark distinguishing this species from the closely-related form *S. plagiusa*, from which otherwise, according to descriptions, it differs but little.

Specimens at hand from Porto Rico show nearly all grades of coloration of the two forms which with measurements cover pretty well the two species. But all of the Porto Rican specimens are undoubtedly of the same species. They have been compared with specimens of *S. plagiusa.* The few specimens of the latter examined revealed none with black caudal, but they differed in no other respect, unless possibly in the slightly larger head and eyes. There can be little doubt but that the two forms are as nearly identical as are the two names.

Some individuals are plain brown, with longitudinal streaks of darker along rows of scales, or with distinct broad crossbars; or with irregular cross-mottling not arranged in definite bands. All of these colors may vary from faint and light to very dark and distinct. The fins are sometimes nearly plain, but usually with more or less numerous narrow dark bars running in direction of fin rays. Color of caudal rays ranging from pale, through longitudinally barred and dusky to very black.

West Indies to Brazil; common. Specimens have been taken at Havana and in Jamaica; in Porto Rico it is known from Palo Seco, Ponce, Mayaguez, Boqueron, and Hucares. The only record from Florida is "Off Key West, in about 20 fathoms" (Garman).

Measurements of 15 specimens of Symphurus plagusia, showing variations.

Locality.	Total length.	Length to base of caudal.	Head.	Depth.	D.	A.	Scales.	Color of tail.
Mayaguez	146	137	5.25	3.5	88	76	90	Black.
Do	92	85	5.33	3.25	90	74	79	Pale.
Palo Seco	120	113	5.33	3.05	88	77	82	Very black.
Do	103	96	5.05	3.43	95	80	86	Black.
Do	94	87	5.12	3.5	96	75	87	Do.
Do	108	100	5.6	3.6	96	83	88	Do.
Do	109	103	5.44	3.5	96	83	88	Do.
Boqueron	117	109	5.5	3.5	96	79	83	Very dusky.
Ponce	109	103	5.15	3.21	96	76	82	Dusky.
Do	93.5	86	5.25	3.5	93	75	82	Slightly dusky.
Do	88	82	5.12	3.25	91	75	78	Barred.
Do	85	78	5.2	3.37	93	77	80	Very slightly dusky.
Do	68	64	5	3.66	93	78	78	Plain pale.
Hucares	90	85	5.33	3.5	92	75	87	Pale.
Do	91	84	5.25	3.5	94	79	82	Do.

Plagusia, Browne, Jamaica, 445, No. 1, 1756, Jamaica.
Pleuronectes plagusia Bloch & Schneider, Syst. Ichth., 162, 1801, Jamaica; after Browne.
Achirus ornatus Lacépède, Hist. Nat. Poiss., IV, 659, 1803, on a specimen "presented by Holland to France."
Plagusia tessellata Quoy & Gaimard, Voyage Uranie, Zoologie, 240, 1824, Rio Janeiro.
Plagusia brasiliensis Agassiz, Spix, Pisc. Brasil., 89, tab. 50, 1829, Brazil.
Aphoristia ornata, Poey, Fauna Puerto-Riqueña, 341, 1881; Stahl, l. c., 80 and 166, 1883.
Symphurus plagusia, Jordan & Evermann, 2709, 1898.

Family LXXV. ANTENNARIIDÆ. The Frog-fishes.

Head and body more or less compressed. Mouth vertical or very oblique, opening upward; lower jaw projecting; jaws with cardiform teeth; premaxillaries protractile. Gill-openings small, pore-like, in or behind lower axils of pectorals. No pseudobranchiæ. Gills 2.5 or 3; skin naked, smooth, or prickly. Pectoral members forming an elbow-like angle. Pseudobrachia long, with 3 actinosts. Ventral fins present, jugular, near together. Spinous dorsal of 1 to 3 separated, tentacle-like spines; soft dorsal long, larger than anal. Pyloric cæca none.

The *Antennariidæ* comprise about 5 genera and 50 species, inhabitants of tropical seas, "living on floating seaweed, and enabled, by filling the capacious stomach with air, to sustain themselves on the surface of the water"; therefore widely dispersed by currents in the sea. The different species display the most grotesque forms and appearance; and, as Dr. Günther well says, there is none, perhaps, in which the singular organization of the fish is more distinctly seen to be in consonance with its habits; and there is none in which mimicry and protective coloration and organization are more strongly or more beautifully exemplified. "The habits of all are equally sluggish and inactive. They are found in all warm seas and are very bad swimmers. Those found near the coasts lie on the bottom of the sea, holding on with their arm-like pectoral fins to seaweeds or stones," among which they conceal themselves. Their colors and dermal filaments resemble the seaweeds very closely and render the fish extremely difficult of detection. The species of pelagic habits attach themselves to floating *Sargassum* or other floating seaweed and are carried about by the winds and currents.

a. Head compressed; a rostral spine or tentacle, followed by 2 larger spines; palatine teeth developed; dorsal spines disconnected.
  b. Skin naked and smooth; ventral fins elongate .... PTEROPHRYNE, 161
  bb. Skin covered with prickles; ventral fins short .... ANTENNARIUS, 162
aa. Head cuboid; a single rostral spine or tentacle, received in a groove; soft dorsal low .... CHAUNAX, 163

Genus 161. PTEROPHRYNE Gill. Mouse-fish.

Body smooth or scarcely granular, short, somewhat compressed, with tumid abdomen; mouth small, oblique; palate with teeth; wrist and pectoral fin slender; ventrals elongated; soft dorsal and anal vertically expanded.

Small fishes of fantastic shape in the West Indies and the Gulf Stream.

a. "Bait" on first dorsal spine bifurcate at tip .... *histrio*
aa. "Bait" on first dorsal spine bulbous, covered with fleshy filaments .... *gibba*, 284

284. **Pterophryne gibba** (Mitchill). *Sapo; Pescador.*

Garman refers to this species certain specimens obtained in Gulf weed about Key West and the Tortugas. These resemble *P. histrio*, but "differ markedly in certain respects. The bait on first dorsal spine, for instance, is bulbous and covered with slender fleshy filaments in our individuals, but in *P. histrio* it is bifurcate. *P. gibba* is fairly represented by Cuvier, 1817, in his *Chironectes lævigatus*. The formula for the individuals in hand is D. III, 12; A. 7; V. 5; P. 10; C. 9." (Garman.) West Indies north to Key West and the Tortugas; not seen by us in Porto Rico but recorded from there by Professor Poey and Dr. Stahl; probably not uncommon but often confounded with *P. histrio*.

Lophius gibbus Mitchill, Trans. Lit. and Phil. Soc. N. Y. 1815, I, pl. 4, fig. 9.
Chironectes lævigatus Cuvier, Mém. du Mus., III, 423, pl. 16, fig. 1, 1817, South Carolina.
?*Chironectes sonntagii* Baron J. W. von Müller, Reisen in den Vereinigten Staaten, Canada, und Mexico, Band I, 180. 1864, in floating seaweed; no exact locality stated.
Pterophryne lævigata, Poey, Fauna Puerto-Riqueña, 340, 1881; Stahl, l. c., 79 and 165, 1883.
Pterophryne gibba, Jordan & Evermann, l. c., 2717, 1898.

Genus 162. ANTENNARIUS Lacépède.

Body oblong, compressed, very deep through occipital region, tapering behind; breast tumid; mouth rather large, more or less oblique, or even vertical; cardiform teeth on jaws, vomer, and palatines; eye small; skin with small granules or spinules, these usually forked, and numerous fleshy slips. First dorsal spine developed as a small rostral tentacle; second and third dorsal spines strong, covered with skin, with numerous fleshy filaments; soft dorsal high and long; anal short and deep; caudal fin rounded, peduncle free; pectoral fins wide, with a rather wide wrist, at lower posterior angle of which are the very small gill-openings; ventral fins short.

Fantastic-looking fishes, very numerous in warm seas, especially in parts of the sea with floating vegetation; not rarely individuals are found far from their native latitudes, carried by currents to the coasts of Norway and New Zealand. Their power of swimming is very imperfect. When near the coast they conceal themselves among corals, stones, or fucus, holding on to the ground by means of their arm-like pectoral fins. The extraordinary range of some of the species which inhabit the Atlantic as well as the Indo-Pacific Ocean, is the consequence of their habit of attaching themselves to floating objects. Their coloration is so similar to their surroundings that it is hardly possible to distinguish the fish from a stone or coral covered with vegetation. Their way of attracting and seizing their prey is evidently the same as in the other fishes of this family. Almost all the species are highly colored, but the pattern of colors varies exceedingly. These fishes do not attain any considerable size, and probably never exceed a length of 10 inches. A great number of species have been distinguished by ichthyologists, but probably not more than twenty are known at present. (Günther.)

A dozen American species of this interesting genus have been recognized, 9 of which occur in the West Indies. The other 3 are found in the Gulf of California and southward on our Pacific coast. Of the 9 West Indian species only 3 have as yet been taken in Porto Rico.

a. Bulbous tip or "bait" of first dorsal spine simple, undivided at tip.
b. Skin smoothish except about eyes; first dorsal spine short, second rough. Body brown, with whitish spots; no ocelli .... *inops*, 285
bb. Skin with prickles, velvety or shagreen-like.
c. Prickles simple, none of them bifid.
d. Color black; tips of pectorals and ventrals and one or two spots on side white (prickles undescribed).... *principis*
dd. Color dusky; dorsal with 3 ocelli; caudal with many spots; first dorsal longer than second; no dermal flaps. *tenebrosus*
cc. Prickles or spinules on body mostly bifid.
e. Body with 3 large ocelli, 1 on dorsal, 1 on caudal, and 1 on middle of side, besides many black spots and streaks; tip of first dorsal spine fringed; mouth largely black within........................ *ocellatus*
aa. Bulbous tip or "bait" on first dorsal spine bifid at tip; skin shagreen-like.
f. Color reddish, with brown spots, those about eye radiating.
g. Dermal flaps numerous on body; spinules on skin short and stiff, rendering surface shagreen-like........ *scaber*, 286
gg. Dermal flaps few; spinules on skin longer and slender, rendering surface velvety........................ *tigris*
ff. Color uniform black; surface of body rough, shagreen-like; inside of mouth white; first dorsal spine short, little longer than second........................ *nuttingii*, 287
aaa. Bulbous tip or "bait" of first dorsal spine trifid.
h. First dorsal ray twice as long as second and as long as caudal; sides with numerous black ocelli, besides other streaks and dark spots; skin smoothish .... *multiocellatus*
hh. First dorsal spine barely one-half longer than second; shorter than caudal; sides with dark streaks and reticulations; a large ocellus under middle of soft dorsal; body rough, with shagreen .... *radiosus*

285. **Antennarius inops** Poey.

Depth 2.75 with caudal. Skin lustrous, smooth, except for some points behind and below eye; third of first 3 dorsal rays largest, its membrane not reaching to vent; second ray also large, but shorter, placed between eyes; first spine developed as a fishing-rod, filiform, ending in a small, membranaceous lobe, its base close to that of second, and therefore distant from end of snout, its spine short, tip not reaching middle of second spine; short tentacles, like horns, on anterior part of third spine, over nostrils and under mouth; caudal rounded; pectoral so joined that it can not be turned forward as usual in this group, but rising obliquely backward and upward. Eye slightly longer than snout; mouth brown within.

Color brown, with white spots on body and median fins, 6 of the largest of these each with the center yellowish, largest from once to twice diameter of eye; spots on dorsal fins small; eye golden.

This species reaches a length of about 3 inches. It is known only from Porto Rico, whence it was originally described; not obtained by us.

Antennarius inops Poey, Anal. Soc. Esp. Hist. Nat., X, 1881, 340, Porto Rico; Jordan & Evermann, l. c., 2718, 1898.
? *Antennarius portoricensis*, Stahl, l. c., 246, 1882, Porto Rico.

286. **Antennarius scaber** (Cuvier).

(PLATE 48.)

D. III–12; A. 7; P. 9 or 10. Anterior dorsal spine as long as second, and provided with 2 long and thick cutaneous flaps at its tip; third dorsal spine not continuous with the soft dorsal; soft dorsal fin terminating at some distance from the caudal, its last ray not extending to root of caudal, if laid backward; dorsal spines, head, back, and sides of body with more or less numerous cutaneous fringes, those of dorsal spines sometimes forming a dense cluster; skin very rough, covered with small spines.

Ground-color yellowish or reddish brown, brightest on back and underneath; body covered with large, irregularly-rounded or oblong brownish spots; head with similar oblong spots; a series of 9 or 10 brown lines radiating from pupil; fins all light-brown or rosy at base, paler on distal portion, each with a number of large roundish black or brownish spots, darkest on anal and pectoral; a series of pale-greenish blotches on interradial membranes near outer margin of each fin; bait pale-yellowish, stem paler; second and third dorsal spines rich brown.

A fish of small size from the Caribbean Sea; known from St. Lucia, Martinique, and Porto Rico; only one specimen, 3 inches long, seined on the coral reef at Mayaguez.

Chironectes scaber Cuvier, Mém. Mus., III, 425, pl. 16. fig. 2, 1817, Martinique.
Antennarius scaber, Jordan & Evermann, l. c., 2722, 1898.

287. **Antennarius nuttingii** Garman. "*Murciélago.*"

(PLATE 49.)

D. III–12; A. 7; V. 5; P. 11; C. 9. In form this species is shorter, more massive anteriorly, and less compressed than either *A. ocellatus* or *A. radiosus*. A tranverse section across middle of body is a nearly equilateral triangle. Caudal region short. Head nearly as wide as high; cheeks swollen; forehead rather broad, converging forward on edges. Occipital concavity wide and deep, free from scales in a wide space below ends of first and second dorsal rays, this bare space being apparently for the reception of the fleshy bait-bulb, which latter has 2 elongate lobes. Snout as long as orbit, broad, truncate; chin vertical; symphyseal knob prominent. Mouth wide, subvertical. Eye small; orbit twice as long, hardly more than one-half interorbital space. First and second dorsal rays equal in length, not inclusive of the 2 elongate fleshy-fringed lobes surmounting first; base of first ray standing forward prominently over mouth, being free for some distance; greater portion of second ray free, while the third is connected with the dorsum by the skin, from base nearly to tip. This last ray is larger than either of its fellows. Soft dorsal large, middle rays longest, as long as distance from maxillary to hind edge of operculum, or as long as rays of caudal fin; fin not reaching back to base of caudal rays, fringed; hind margin of caudal convex, fringed; anal moderate, rays prominent in the margin, fin with a blunt angle on outer edge, subtending, when laid up against the tail, one-fourth or more of the length of the caudal rays; rays on pectoral fins extending out beyond margins more noticeably than those of other fins; ventrals small, in most instances with 6 points on outer margin, in one case having but 5; greatest length of caudal nearly one-fourth of total length; length of each maxillary two-thirds of caudal; scales short, small, close-set, harsh to the touch, having none of the velvety appearance.

Color in life: Entire body and head and bases of all fins black, with washing of rusty-brownish; middle of dorsal fin and outer parts of other fins more rusty; margin of dorsal black; each of the other fins with a distinct but narrow creamy-white border; bait white; inside of mouth black.

Until now this fish was known only from the Bahama Banks, where the type was collected by the Nutting expedition. Two specimens, each about 1.75 inches long, were obtained near the coral reef at Mayaguez, in company with the specimen of *A. scaber*.

Antennarius nuttingii Garman, Bull. Iowa Lab. Nat. Hist. 1896, 83, pl. II, Great Bahama Banks; Jordan & Evermann, l. c., 2723, 1898.

Genus 163. CHAUNAX Lowe.

Head very large, depressed, cuboid. Mouth large, subvertical; jaws and palate with bands of small teeth. Skin with small, sharp spines. Spinous dorsal reduced to a small tentacle above snout, retractile into a groove; soft dorsal moderate, low; anal short; ventrals small. Gills 2.5; no pseudobranchiæ. Muciferous channels very conspicuous, lateral line prominent, undulate; another series of mucous tubes extending from lower jaws to axil; still another extending backward from snout and maxillary to a point behind eye, when it ceases, uniting with a vertical line which extends from lateral line to lower line, these lines thus inclosing a quadrate area on cheek. Gill-opening small, well behind pectoral under front of soft dorsal.

Small, fantastic, deep-sea fishes.

a. Dorsal rays 11; anal 5; depth 2.5 in length .... *pictus*, 288
aa. Dorsal rays 13; anal 7; depth 2.4 in length .... *nuttingii*

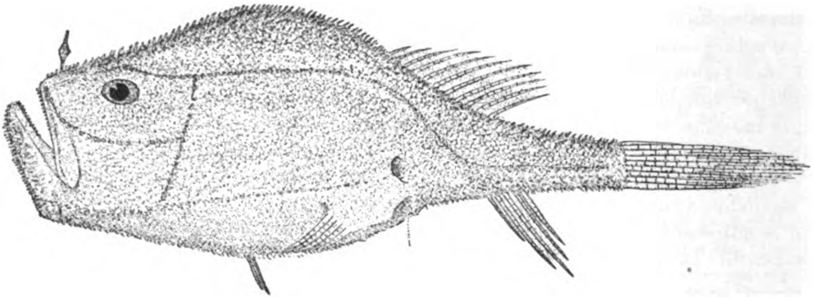

FIG. 109.—*Chaunax pictus.*

288. Chaunax pictus Lowe.

Head 1.6; depth 2.5; D. I, 11; A. 5; P. 11; V. 4; C. 7. Rostral tentacle short, pedicellate; muciferous channels appearing as chain-like rows of pits.

Color in spirits: Pale, with faint rosy shades persisting on back, caudal peduncle, and sides of head.

Deep waters of the Atlantic; known from Madeira, Soudan, Cape Verde, Barbados, off Rhode Island, and elsewhere in the Gulf Stream, in 130 to 428 fathoms. Our single specimen, 2 inches in length, was taken in the beam trawl at Fish Hawk station 6070, 9 miles from Mayaguez, in 220 fathoms.

Chaunax pictus Lowe, Trans. Zool. Soc. Lond. 1846, 339, Madeira; Jordan & Evermann, l. c., 2726, 1898.
?*Chaunax fimbriatus* Hilgendorf, Sitzber. Ges. Naturf. Freunde 1879, 80, Sea of Japan.
?*Chaunax nuttingii* Garman, Bull. Lab. Nat. Hist. Iowa Univ. 1896, 85, near Sand Key light, Florida, in 120 fathoms.

Family LXXVI. OGCOCEPHALIDÆ. The Bat-fishes.

Head very broad and depressed, snout more or less elevated, trunk short and slender. Mouth not large, subterminal or inferior, lower jaw included; teeth villiform or cardiform. Gill-openings very small, above and behind axils of pectoral fins. Body and head covered with bony tubercles or spines. Spinous dorsal reduced to a small rostral tentacle, which is retractile into a cavity under a prominent process on forehead; in one genus the rostral tentacle is obsolete; soft dorsal and anal fins small and short; ventrals well developed; pectoral fin well developed, its base strongly angled, with long pseudobrachia and 3 actinosts. Branchiostegals 5; no pseudobranchiæ. There are 8 genera and about 30 species of these fishes, chiefly American, some of them in the deep sea.

OGCOCEPHALINÆ:

a. Disk with frontal region elevated and the snout more or less produced forward; the tail stout; orbits lateral: teeth on vomer and palatines; rostral tentacle present.

b. Gills 2.5; disk longer than broad........ OGCOCEPHALUS, 164

HALIEUTINÆ:

aa. Disk with frontal region depressed, not elevated above the rest; eyes partly superior; snout rounded, obtuse in front; tail slender.

c. Dorsal fin present.

d. Vomer and palatines with teeth........ HALIEUTICHTHYS, 165

dd. Vomer and palatines toothless.

e. Disk subcircular; gills 2.5.

f. Mouth rather small, terminal; prickles feeble........ HALIEUTELLA

ee. Disk subtriangular; gills 2; prickles very strong........ DIBRANCHUS

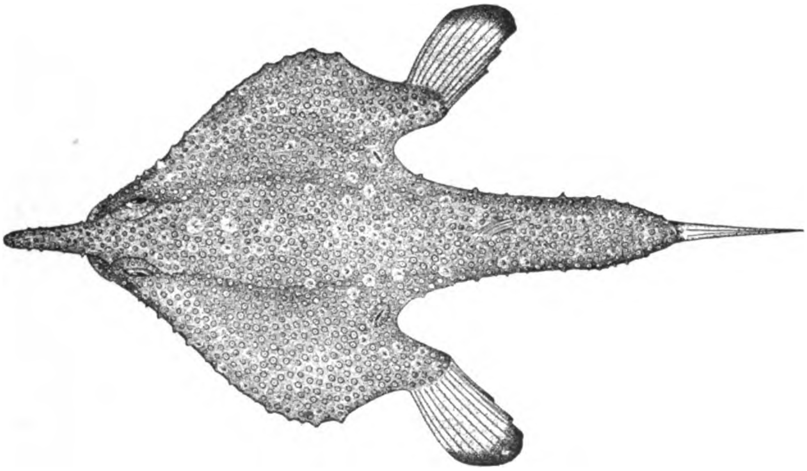

FIG. 110.—*Ogcocephalus vespertilio*, dorsal view.

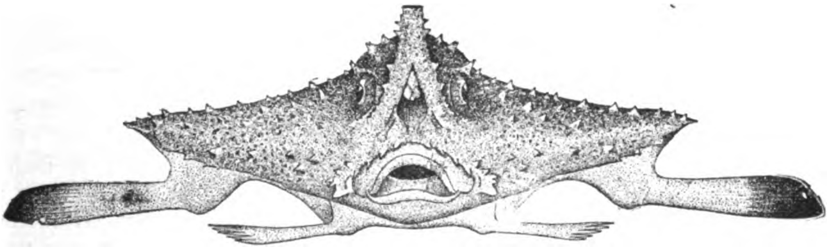

FIG. 111.—*Ogcocephalus vespertilio*, front view.

Genus 164. OGCOCEPHALUS Fischer. Sea Bats.

Body stoutish, tapering backward; head very broad and depressed, triangular in form, forehead elevated and produced. Eyes large, lateral. Mouth rather small, subinferior under snout; villiform teeth in bands, on jaws, vomer, and palatines. Skin covered with rough, bony tubercles. Dorsal and anal fins very small; rostral tentacle present, retractile into a cavity under a bony prominence on forehead; ventrals present, I, 5, well separated; pectorals large, placed horizontally. Gills 2.5. No air-bladder; no pyloric cæca.

Tropical America, in shallow water. Small fishes of singular form, often regarded by the ignorant as venomous.

a. Snout produced, rostral process pointed, 6 to 10 in length of body........ *vespertilio*, 289

aa. Snout short, rostral process 12 to 15 times in length of body........ *nasutus*

aaa. Snout short, rostral tubercle reduced to a button-like tubercle, which is about 25 times in length of body.. *radiatus*

289. Ogcocephalus vespertilio (Linnæus). *Bat-fish; Diablo; Murciélago de Mar.*

Head, from tip of upper jaw to gill-opening, nearly one-half the length; depth 5 in length from upper jaw to base of caudal; width 1.8; D. 4; A. 4; rostral process from 6 to 10 (9 in our specimens from Havana); pectoral 4.5; ventral 6; caudal 4.25. Body stoutish, much depressed, rostral process longer than in other species, variable in length; mouth small, maxillary reaching nearly to posterior margin of eye; villiform teeth in bands, on jaws, vomer, and palatines; interorbital flattish, its width less at anterior end of eyes than at posterior; rostral groove longer than broad; body covered with bony protuberances, variable in size, and not very definite in position, lower parts with a shagreen-like covering; posterior edge of pectorals much behind middle of body; ventrals long, reaching outward to edge of the disk-like anterior part of body; origin of dorsal over posterior edge of pectoral; anal under vertical of tips of dorsal rays, and reaching nearly to base of caudal. Pale grayish-brown above, reddish below; back with round black spots, conspicuous in life, but growing fainter and sometimes disappearing in spirits; belly in life a coppery-red; pectoral nearly plain dusky.

West Indies, north to the Florida Keys; common in shallow water. Length 12 inches.

Recorded from Porto Rico by Professor Poey and Dr. Stahl. Here described from a specimen from Havana, Cuba, about 10 inches in length. The length of snout is subject to great variation, but it is never short and button-like, as in *O. radiatus*.

Lophius vespertilio Linnæus, Syst. Nat., ed. X, 1, 236, 1758, American Seas; after *Lophius fronti unicorni* of Artedi.
Malthcæa longirostris Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 452, 1837, Bahia.
Malthe vespertilio, Poey, Fauna Puerto-Riqueña, 341, 1881; Stahl. l. c., 79 and 165, 1883.
Ogcocephalus vespertilio, Jordan & Evermann, l. c., 2737, 1898.

Genus 165. HALIEUTICHTHYS Poey.

Disk subcircular, anteriorly cordiform, head merging into body, very large and much depressed; cranial portion not elevated; interorbital space low and narrow; eyes partly superior; mouth terminal, horizontal, jaws subequal, the lower jaw nearly semicircular; teeth fine, on jaws and palate. Gills 2.5; no gillrakers; gill-openings anterior to pectoral; rostral tentacle very small, rectractile; dorsal and anal few-rayed; pectoral large; carpus slender; caudal rounded; skin above sparsely armed with stellate tubercles; lower surface smooth.

a. Surface of body covered with brownish reticulations .... *aculeatus*, 290
aa. Surface of body blackish, not reticulate; pectoral with a broad black bar.
  b. Eye 4; interorbital 2 in eye; nostrils comparatively remote .... *smithii*, 291
  bb. Eye smaller; interorbital narrower; nostrils nearer together .... *caribbæus*

290. Halieutichthys aculeatus (Mitchill).

Head 1.8; depth 6; eye 5; interorbital 1.8 in eye, 8 or 9 in body; D. 5; A. 4; pectoral of 17 rays, 1.5 in head; caudal of 9 rays, 1.6 in head. Disk about as broad as long, its breadth equal to distance from tip of snout to base of last dorsal ray; body above with many conical spines with stellular bases, those at edge of disk usually 3-pointed, divergent; body smooth below; snout very short, obtuse, bridge over rostral cavity with a 3-pointed spine in front, a simple smaller one on each side; simple spines upon each supraorbital margin, and a row of about 5 on lower margin of eyeball, attached by a fleshy flexible membrane; many slender filaments on edge of disk and sides of trunk; supraoral cavity with a club-shaped tentacle.

Color in spirits: Body white below, darker above with obscure brownish markings; pectoral and caudal with 3 dark bars, outer widest and darkest, the 2 inner of the pectoral obscure in our specimen.

West Indies, Gulf of Mexico, and Gulf Stream, in water of moderate depth. One specimen, 2.75 inches long, taken by beam trawl in 75 fathoms at Fish Hawk station 6063, off Mayaguez, January 20.

Lophius aculeatus Mitchill, Amer. Month. Mag., II, 1818, 325, Straits of Bahama.
Halieutichthys aculeatus, Jordan & Evermann, l. c., 2739, 1898.

291. **Halieutichthys smithii** Evermann & Marsh, new species.

Head 2; depth 6; eye 4; interorbital 2 in eye; D. 1-5; A. 4; P. 17; V. 5; C. 9. Body not so wide as in *H. aculeatus*, the anterior edge being more evenly rounded, the lateral edges less divergent, and the posterior angles less salient; spines on body small and obscure, those on margin more prominent; tail smooth, without spines; snout broad; rostral spine small; eye very large; interorbital space wide; margin of body with a prominent fringe of filaments.

Color much as in *H. aculeatus* but lighter and without any reticulations; proximal half of pectoral pale, then a broad jet-black band on about nine of the interradial membranes only (the rays being pale), the outer fourth pale; caudal pale, somewhat dark at tip.

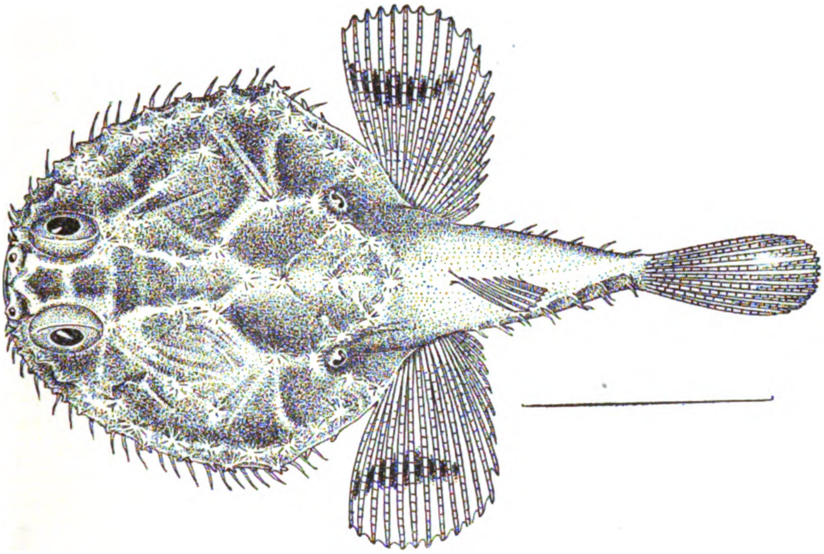

FIG. 112.—*Halieutichthys smithii.*

This species is close to *H. caribbæus* Garman; from which it differs in the much larger eye, wider interorbital, more remote nostrils and the coloration.

One specimen, the type (No. 49537, U. S. N. M.) 3.25 inches long, collected by the *Fish Hawk* at Station 6063, in Mayaguez Harbor, in 75 fathoms, taken by the beam trawl on sand and coral bottom.

We name this interesting species for Dr. Hugh M. Smith, chief of the Division of Scientific Inquiry of the United States Fish Commission.

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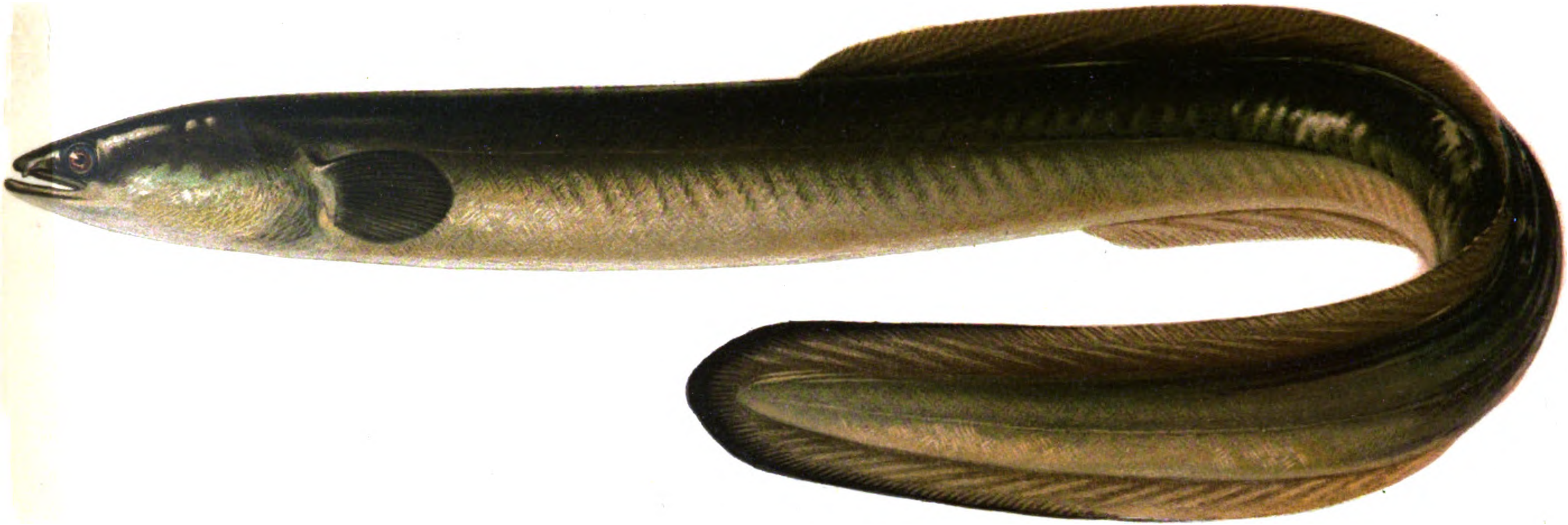
PLATE I.



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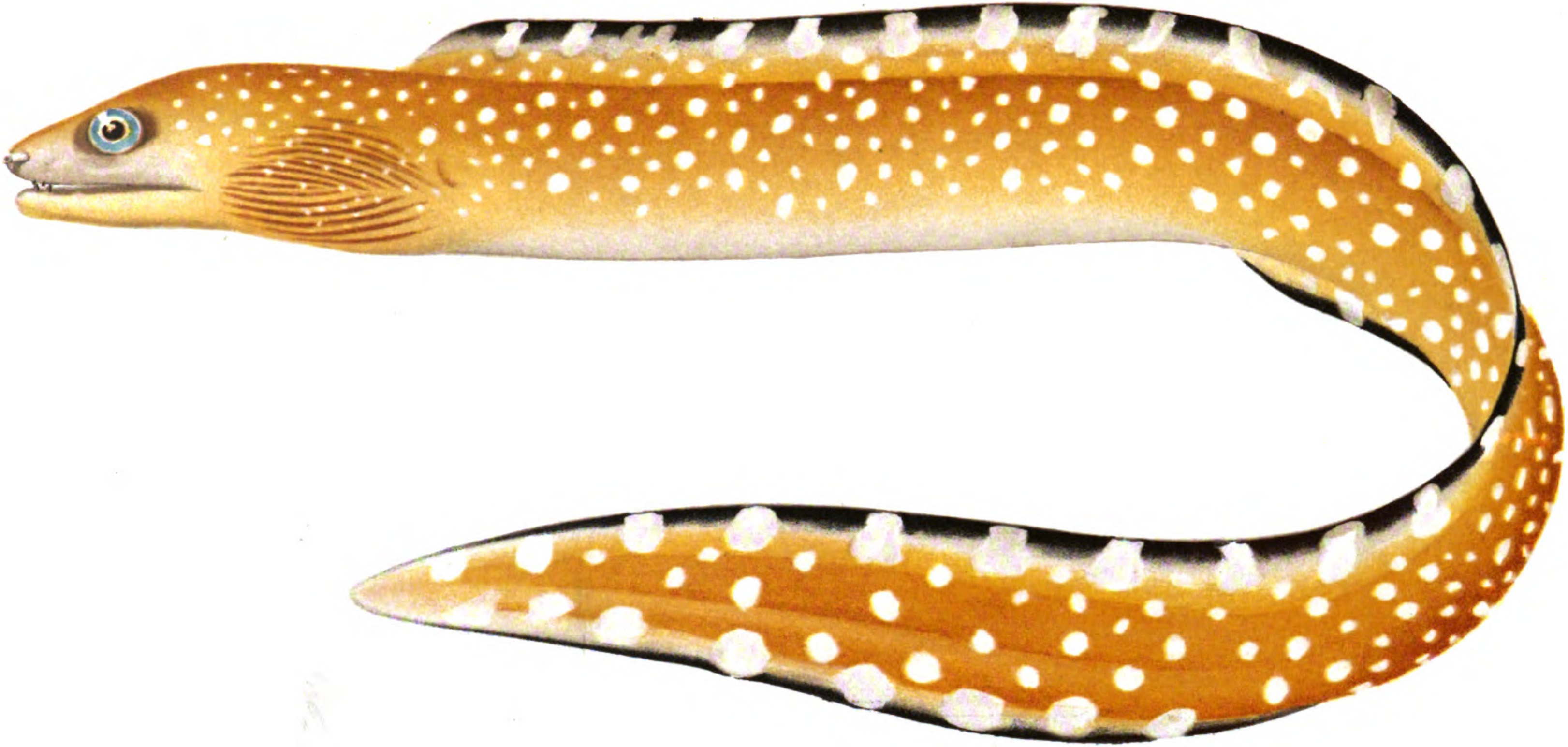
JULIUS BIEN & CO. LITH N.Y.

ANGUILLA CHRYSYPA RAFINESQUE. COMMON EEL; ANGUILLA.

ABOUT ONE-THIRD NATURAL SIZE.

PLATE 2.



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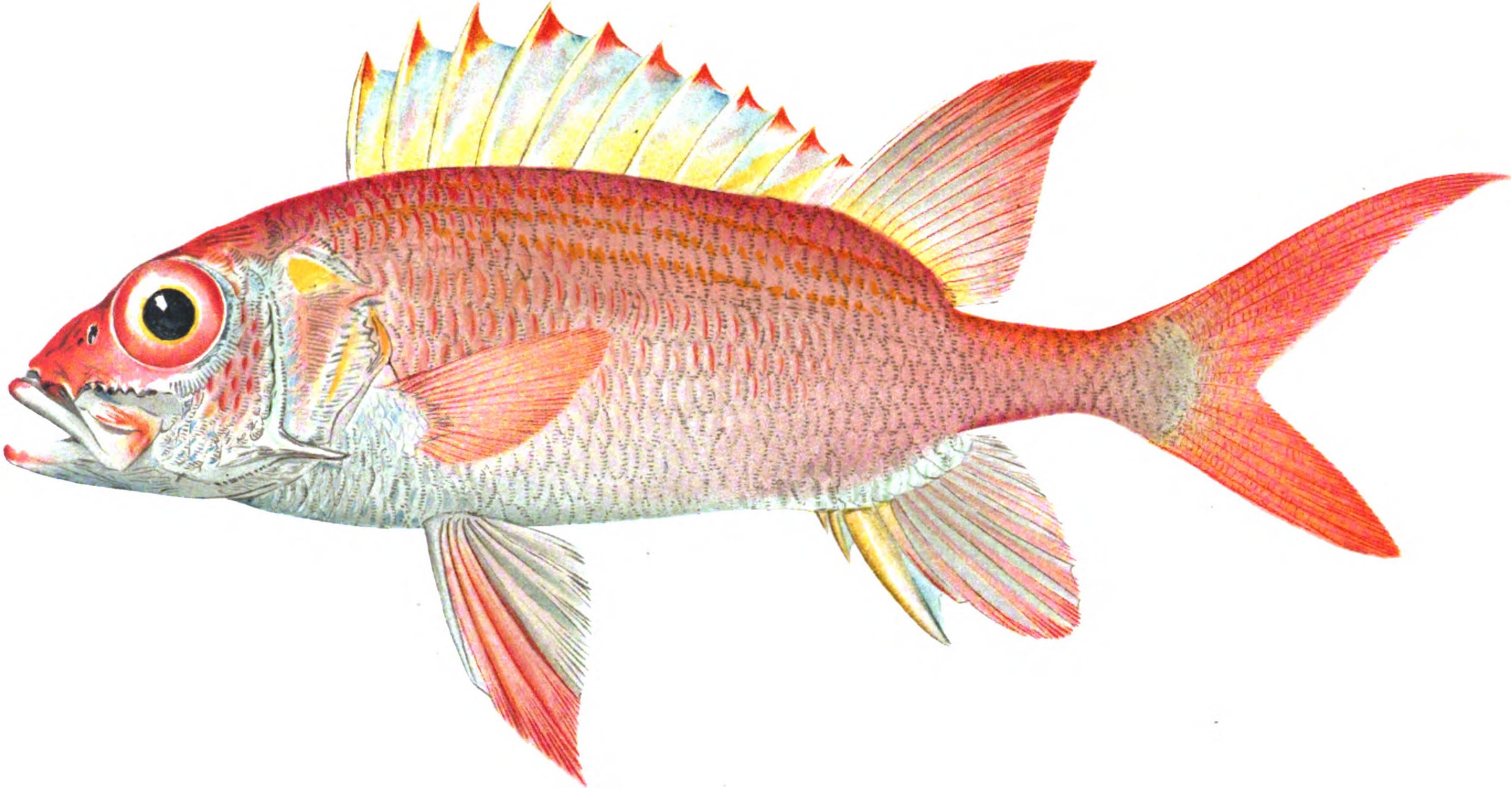
LYCODONTIS JORDANI EVERMANN & MARSH. TYPE.

ABOUT HALF NATURAL SIZE.

PLATE 3.



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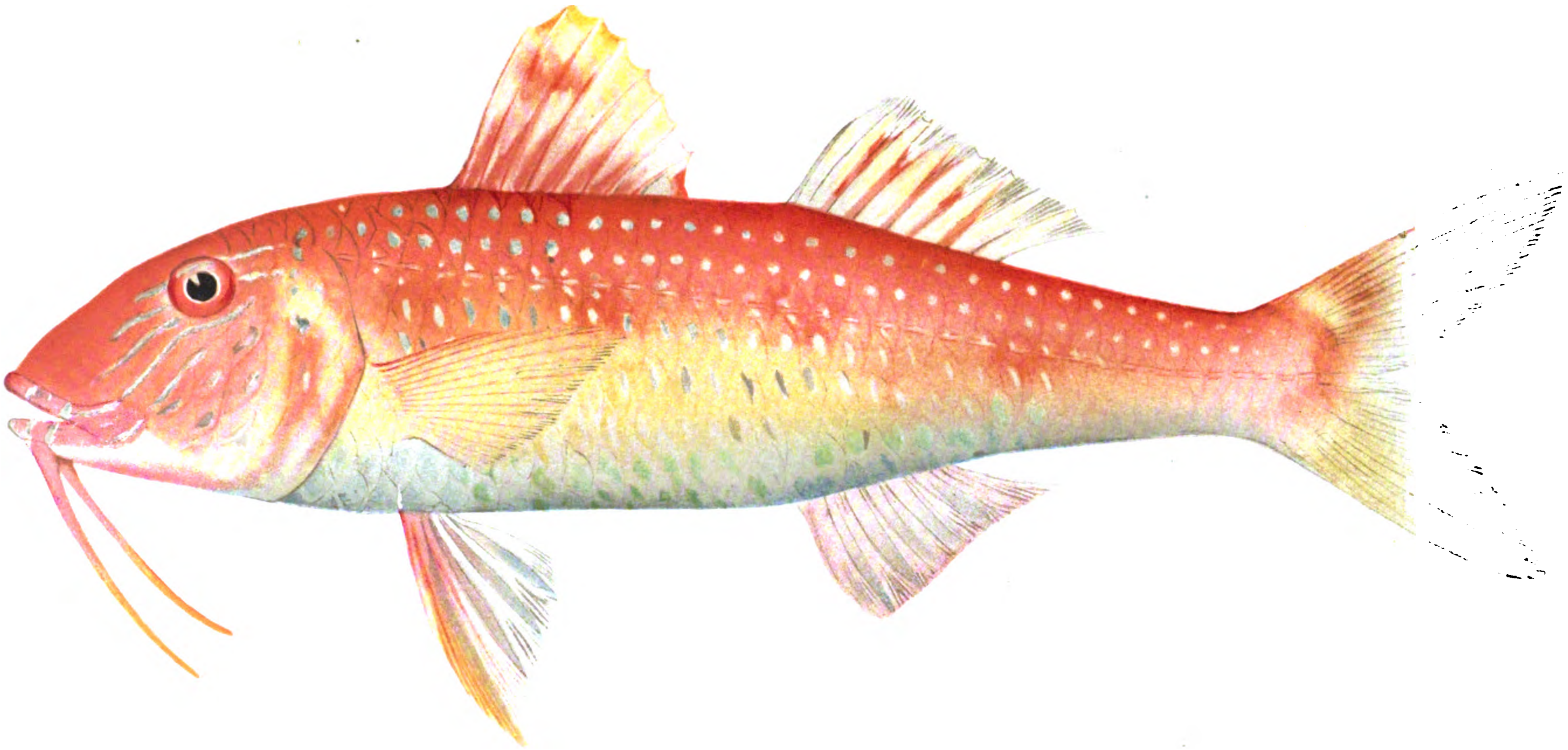
HOLOCENTRUS ASCENSIONIS (OSBECK). SQUIRREL-FISH; CANDIL.

NATURAL SIZE.

PLATE 4.



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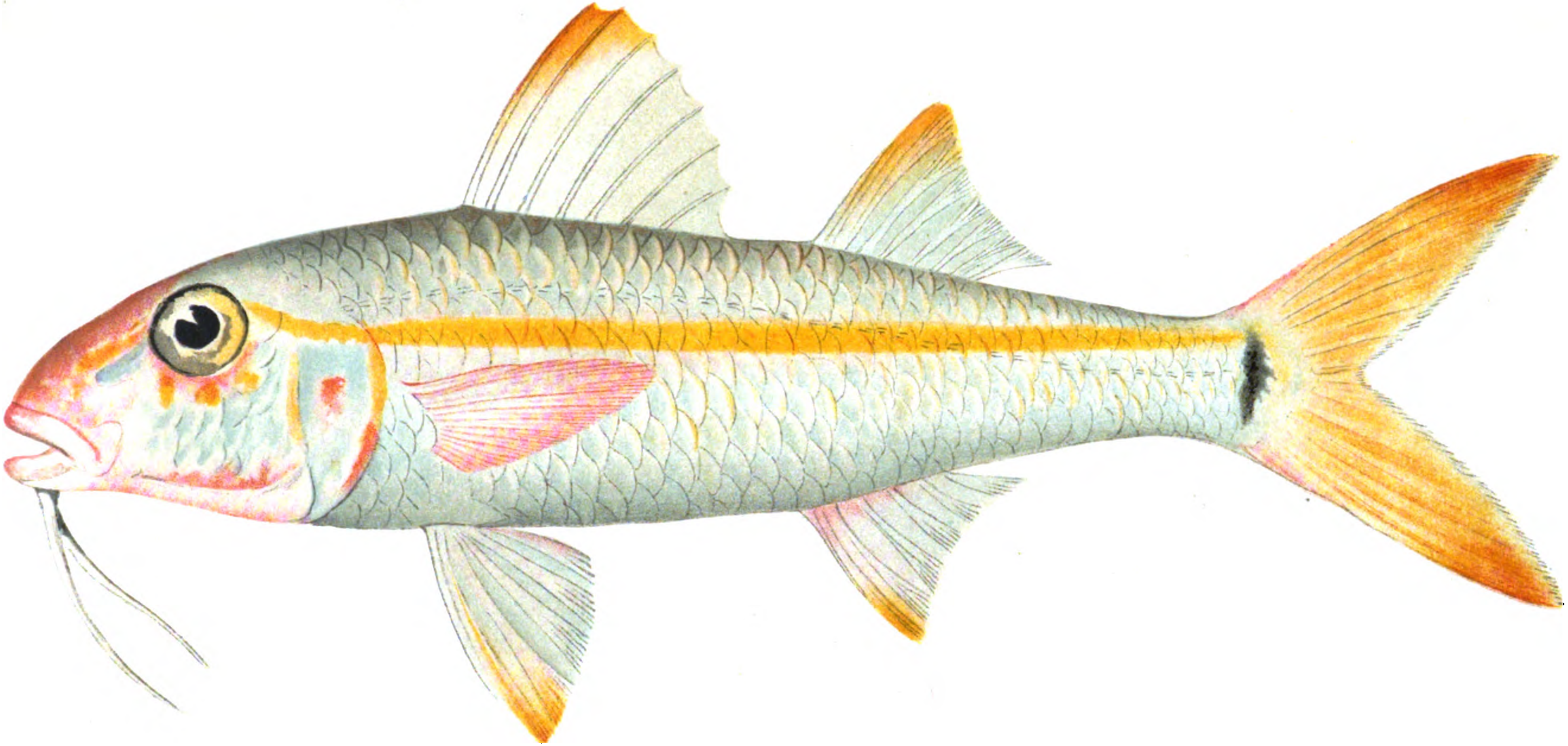
UPENEUS MACULATUS (BLOCH). RED GOAT-FISH; SALMONETE.

NATURAL SIZE.

PLATE 5.



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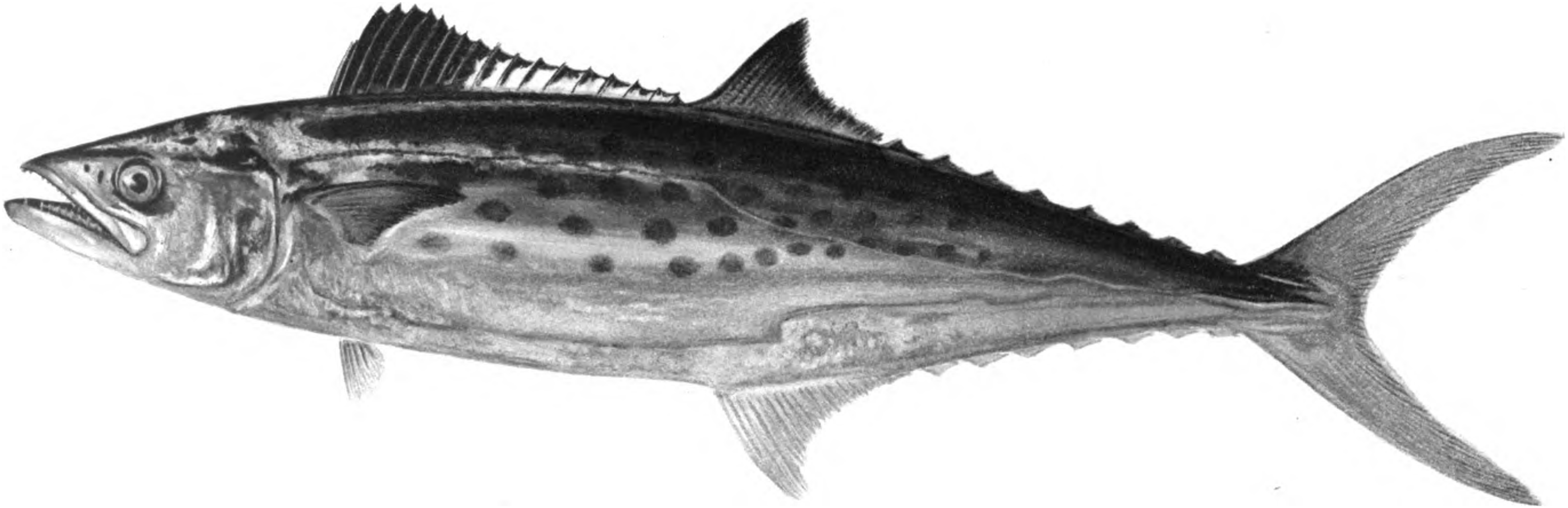
UPENEUS MARTINICUS CUVIER & VALENCIENNES. YELLOW GOAT-FISH; SALMONETE.

ABOUT 1½ TIMES NATURAL SIZE.



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SCOMBEROMORUS MACULATUS (MITCHILL). SPANISH MACKEREL; SIERRA.

ABOUT HALF NATURAL SIZE.

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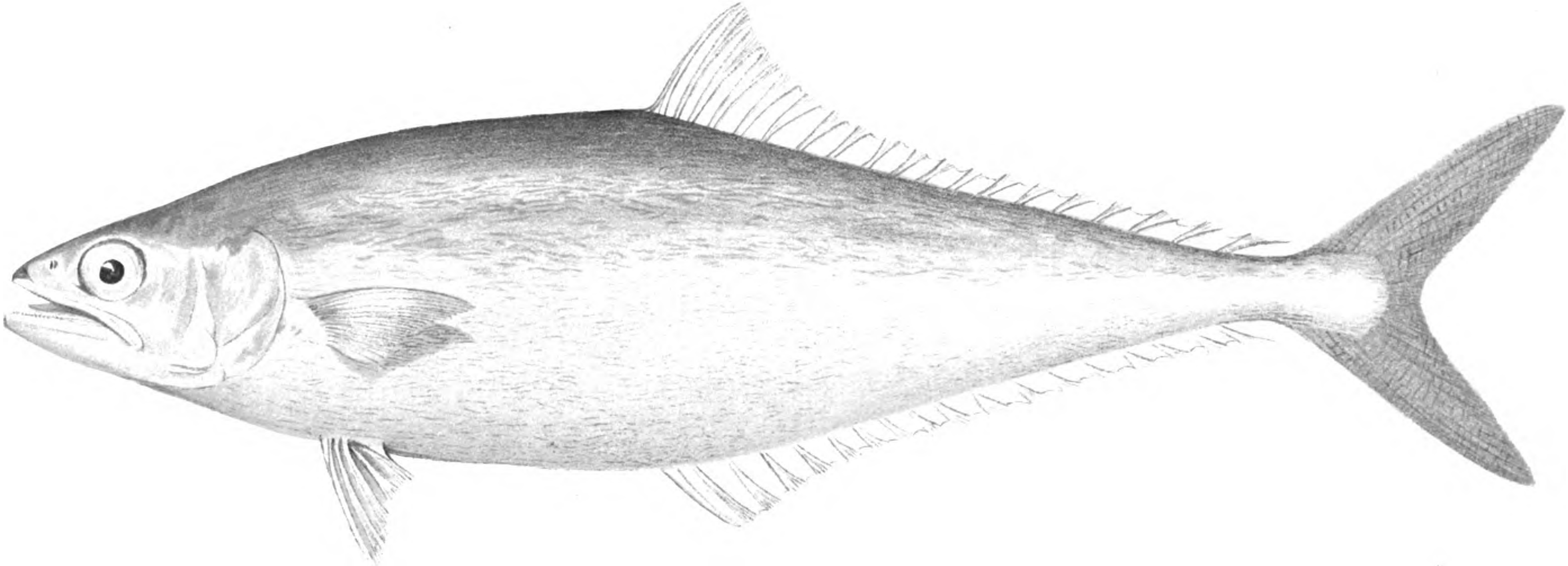

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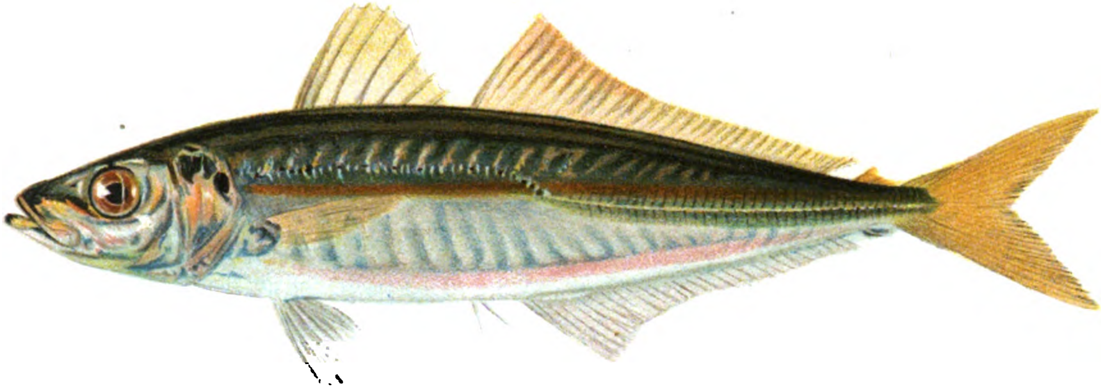
OLIGOPLITES SAURUS (BLOCH & SCHNEIDER). LEATHER-JACK; ZAPATERO.

ABOUT NINE-TENTHS NATURAL SIZE.



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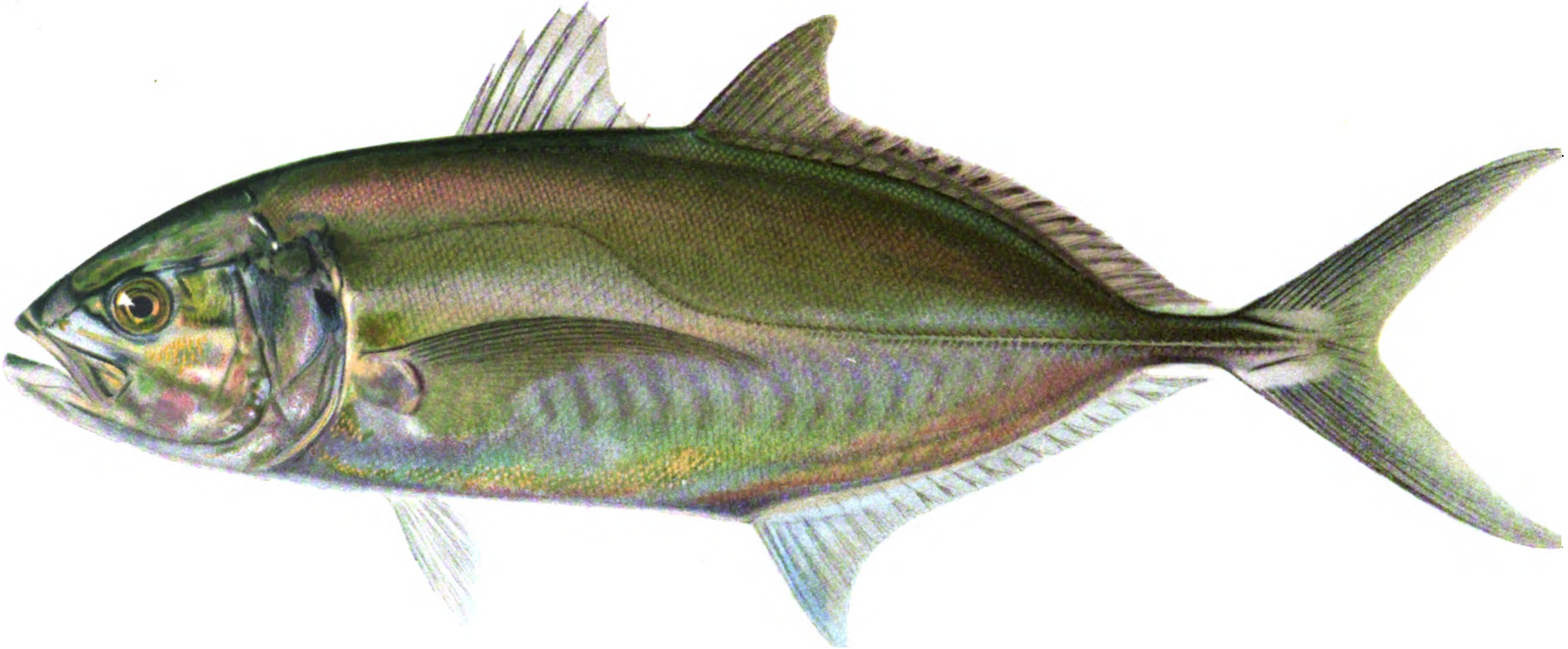
DECAPTERUS PUNCTATUS (AGASSIZ). SCAD; CABALLO AZUL.

ABOUT NATURAL SIZE.

PLATE 9.



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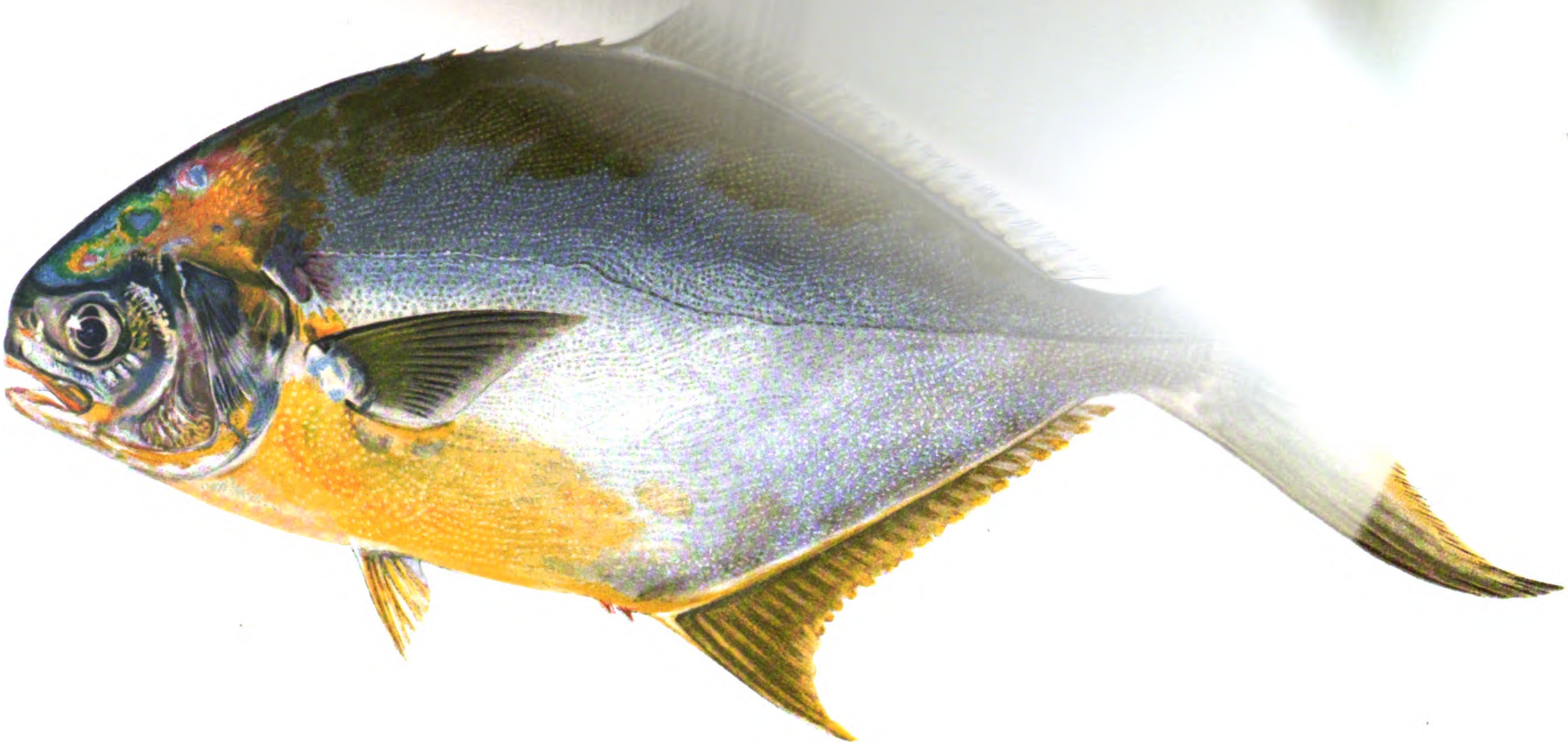
CARANX CRYSOS (MITCHILL). RUNNER.
ABOUT THREE-FIFTHS NATURAL SIZE.



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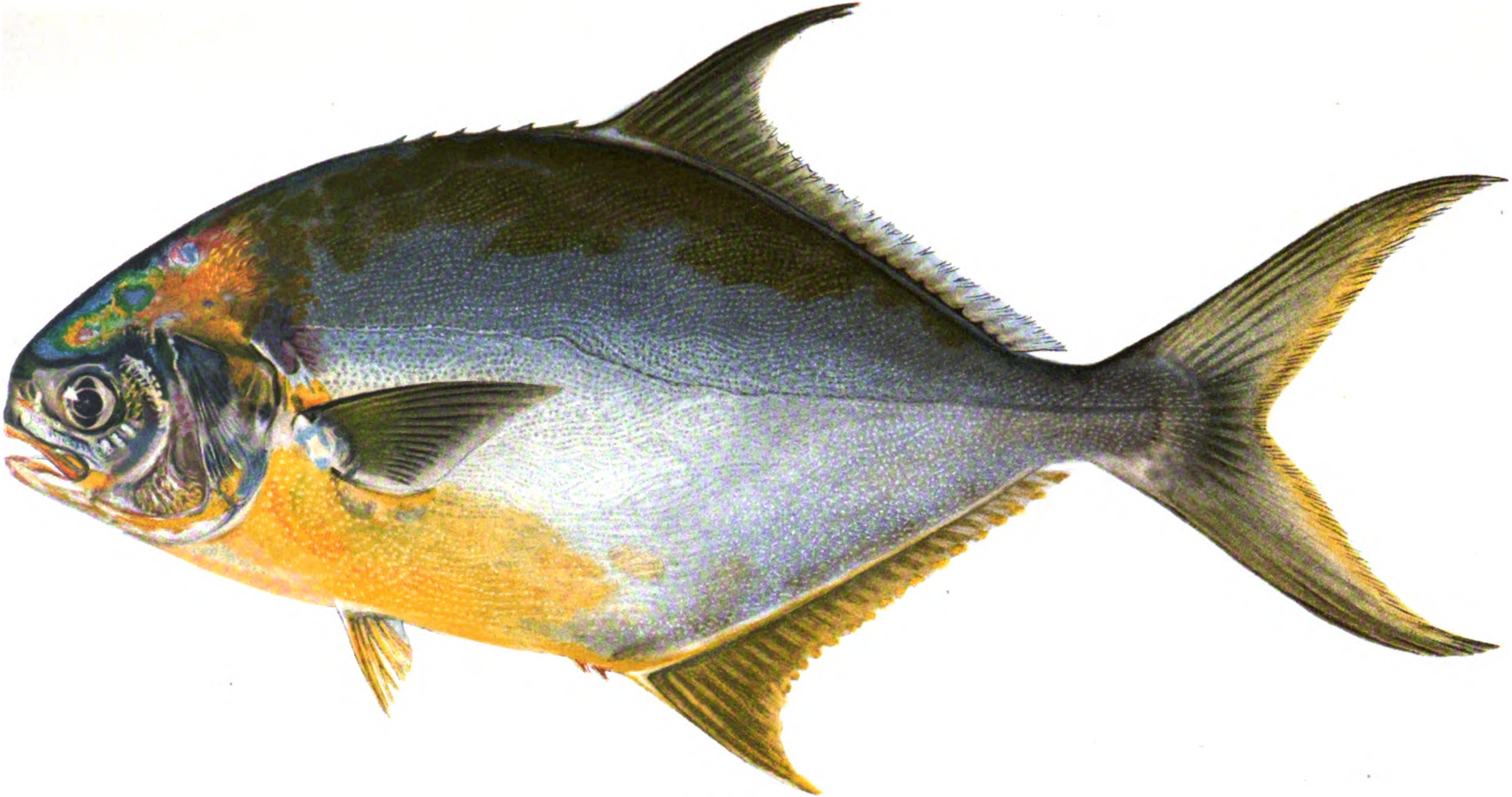
JULIUS BIEN & CO. LITH. N.Y.

TRACHINOTUS CAROLINUS (LINNÆUS). COMMON POMPANO; PÁMPANO.

ABOUT HALF NATURAL SIZE.

PLATE 10.



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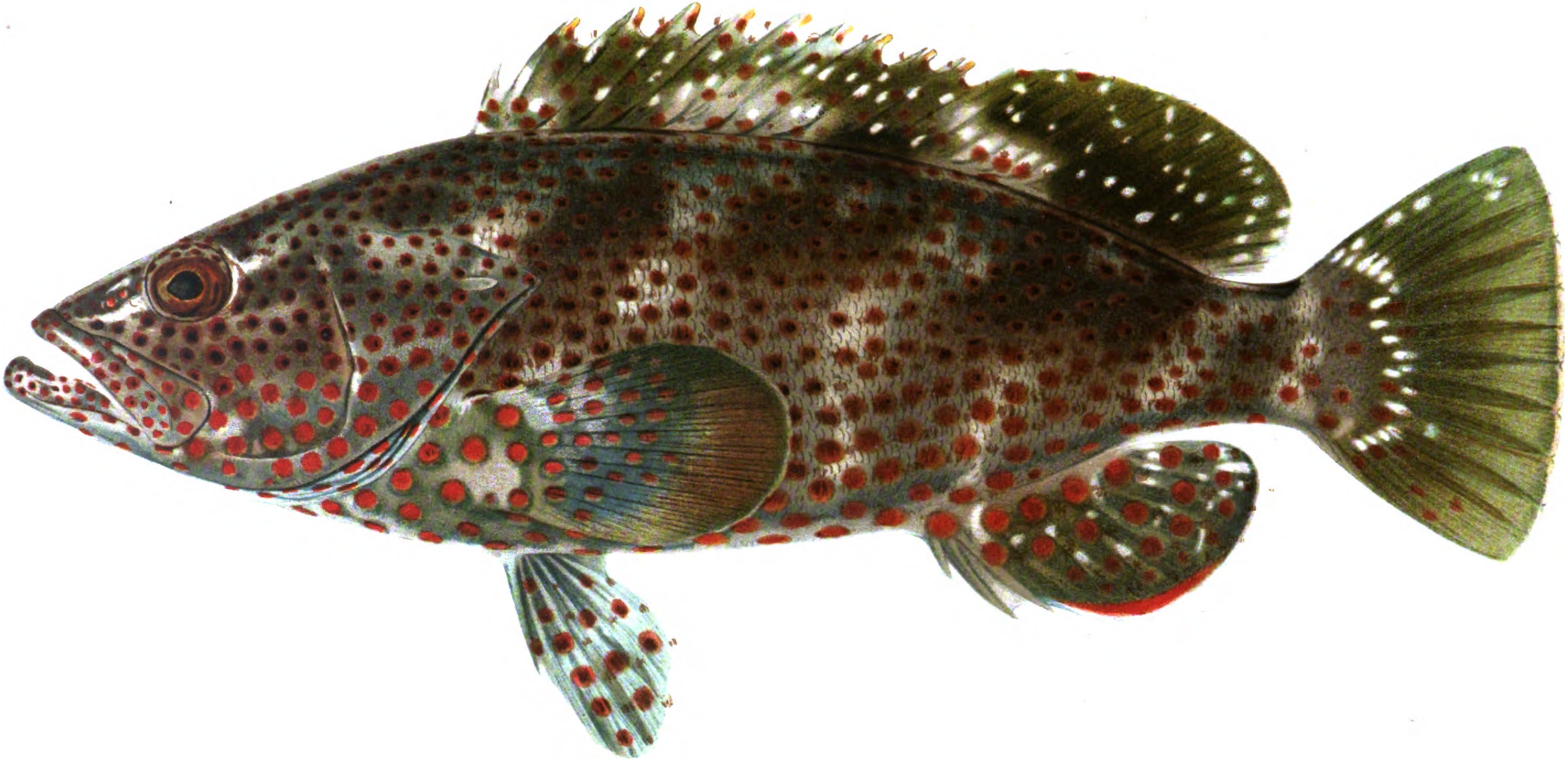
TRACHINOTUS CAROLINUS (LINNÆUS). COMMON POMPANO; PÁMPANO.

ABOUT HALF NATURAL SIZE.

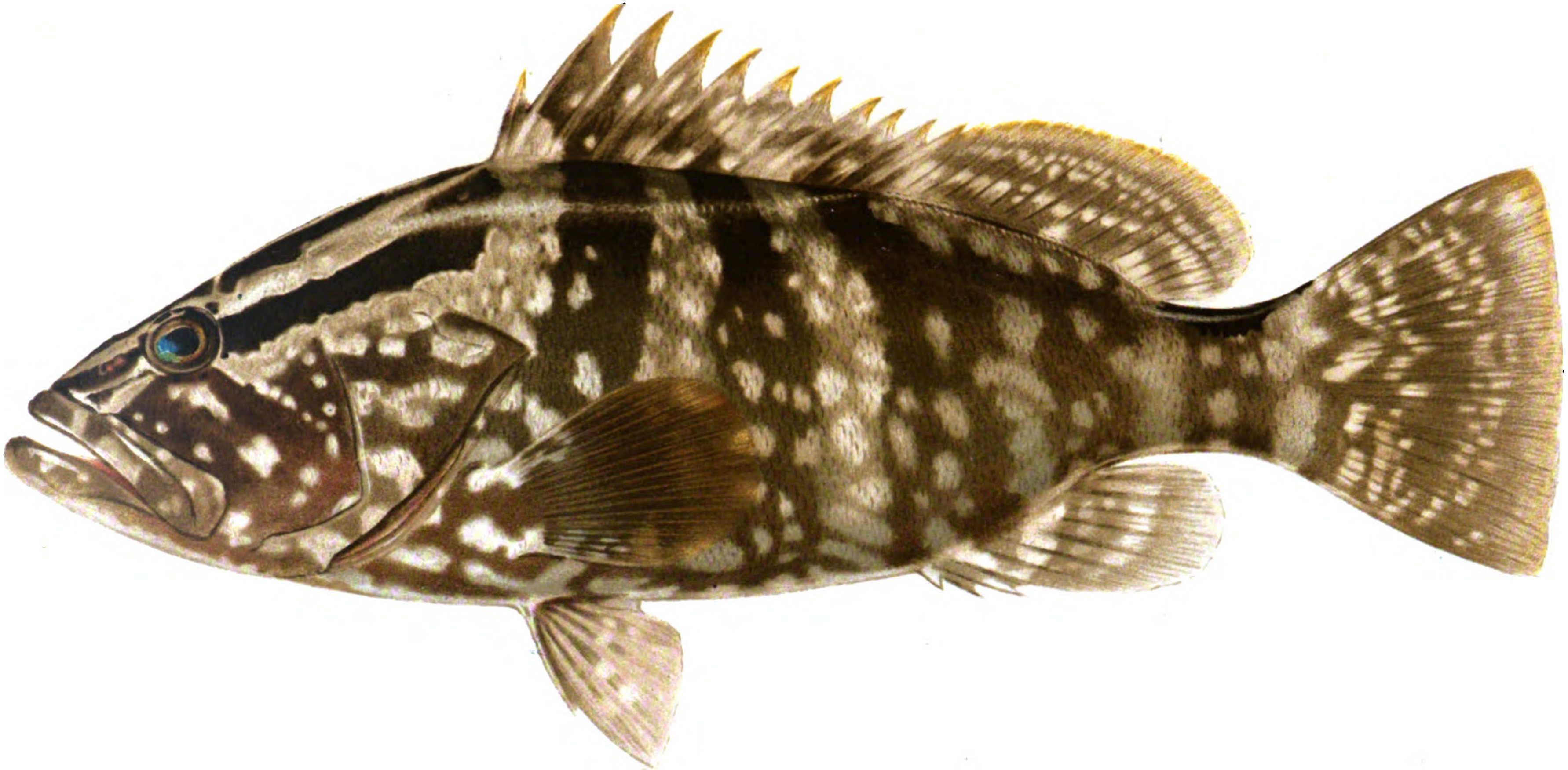


C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

EPINEPHELUS ADSCENSIONIS (OSBECK). ROCK HIND; CABRA MORA.

ABOUT THREE-FOURTHS NATURAL SIZE.



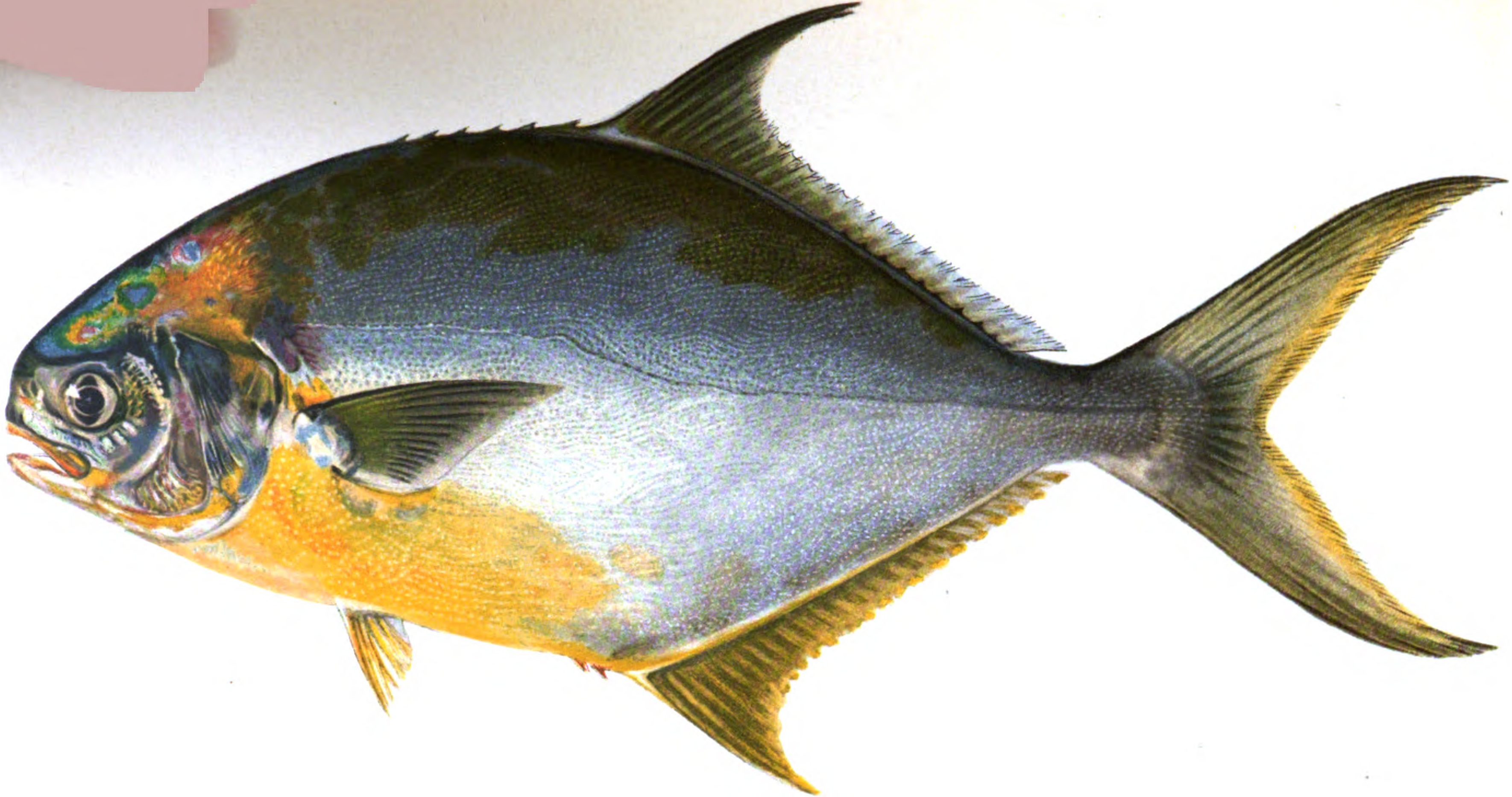
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

EPINEPHELUS STRIATUS (BLOCH). NASSAU GROUPER; CHERNA.

ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 10.



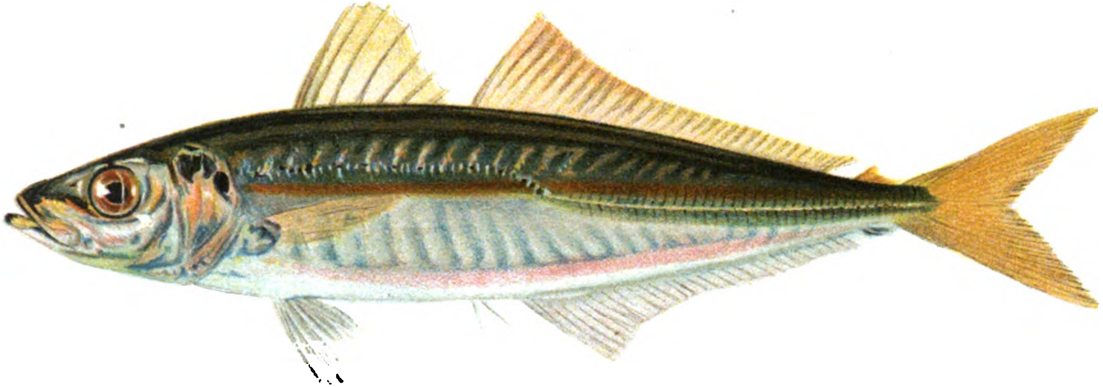
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

TRACHINOTUS CAROLINUS (LINNÆUS). COMMON POMPANO; PÁMPANO.

ABOUT HALF NATURAL SIZE.

PLATE 8.



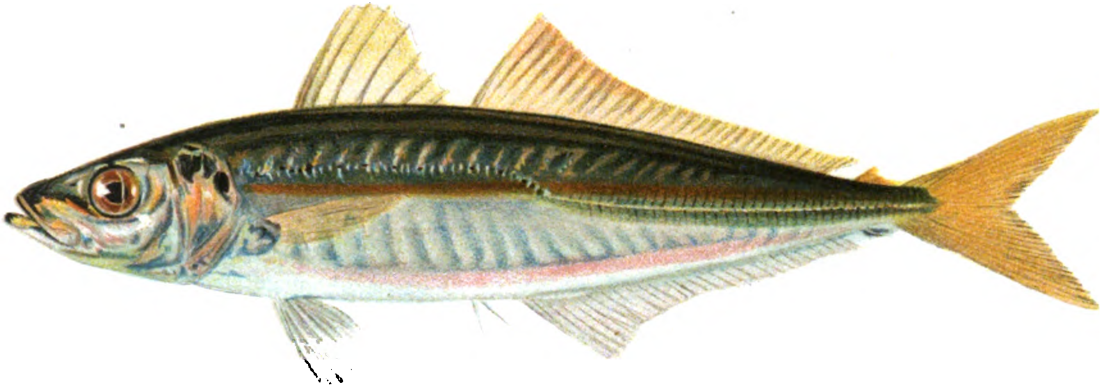
C.B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

DECAPTERUS PUNCTATUS (AGASSIZ). SCAD; CABALLO AZUL.

ABOUT NATURAL SIZE.

PLATE 8.



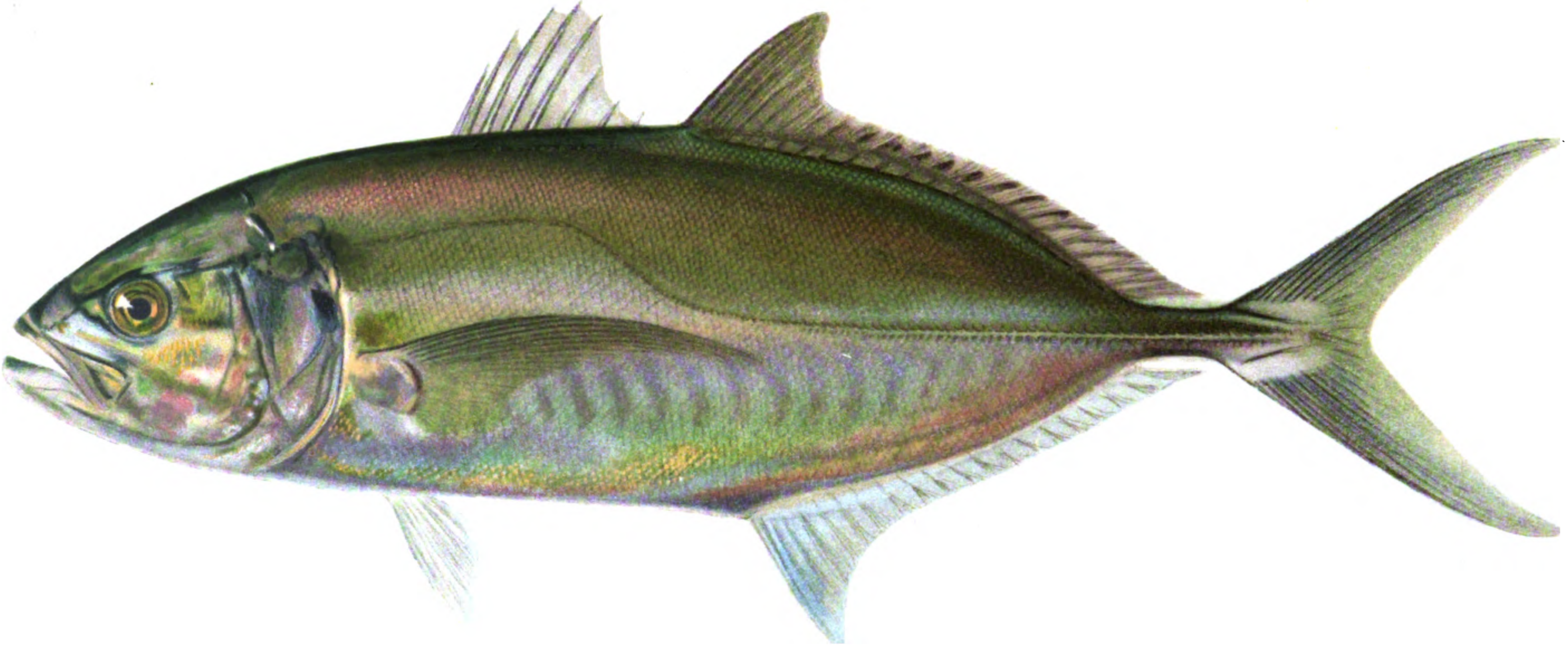
C.B. Hudson ad nat.del.

JULIUS BIEN & CO. LITH N.Y

DECAPTERUS PUNCTATUS (AGASSIZ). SCAD; CABALLO AZUL.

ABOUT NATURAL SIZE.

PLATE 9.

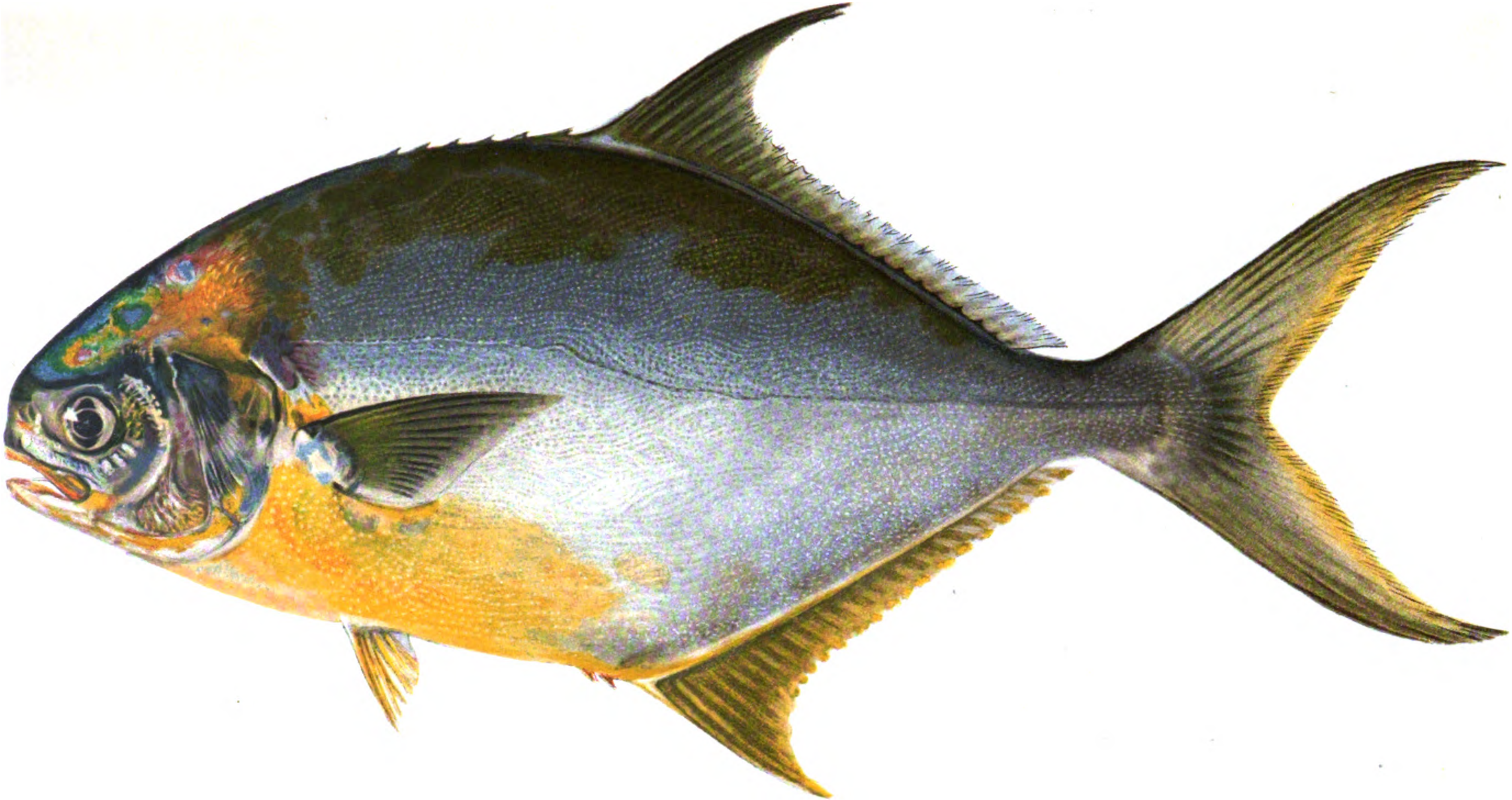


C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

CARANX CRYSOS (MITCHILL). RUNNER.
ABOUT THREE-FIFTHS NATURAL SIZE.

PLATE 10.



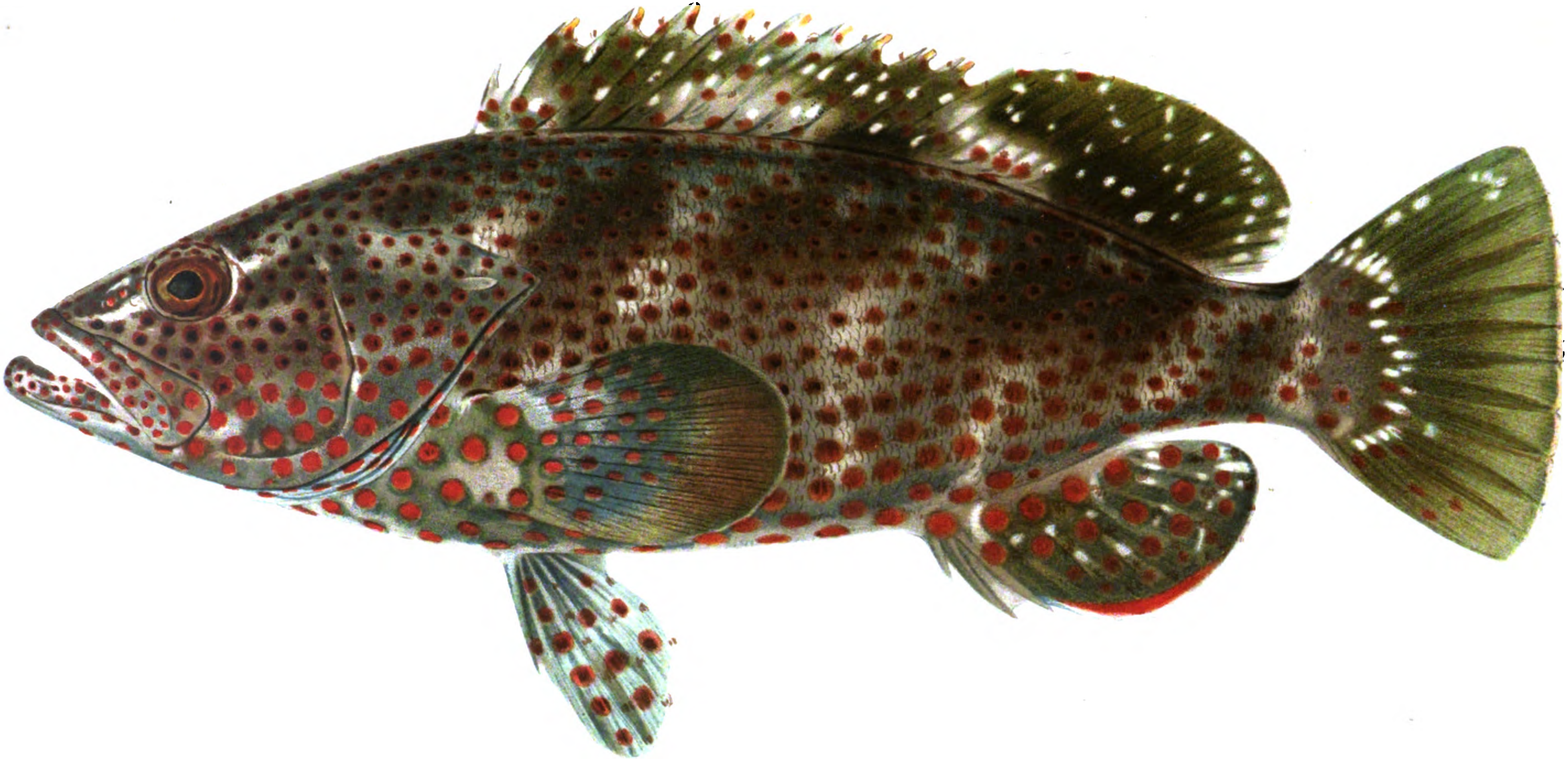
C.B. Hudson ad nat. del.

JULIUS BIEN & CO LITH N.Y.

TRACHINOTUS CAROLINUS (LINNÆUS). COMMON POMPANO; PÁMPANO.

ABOUT HALF NATURAL SIZE.

PLATE II.

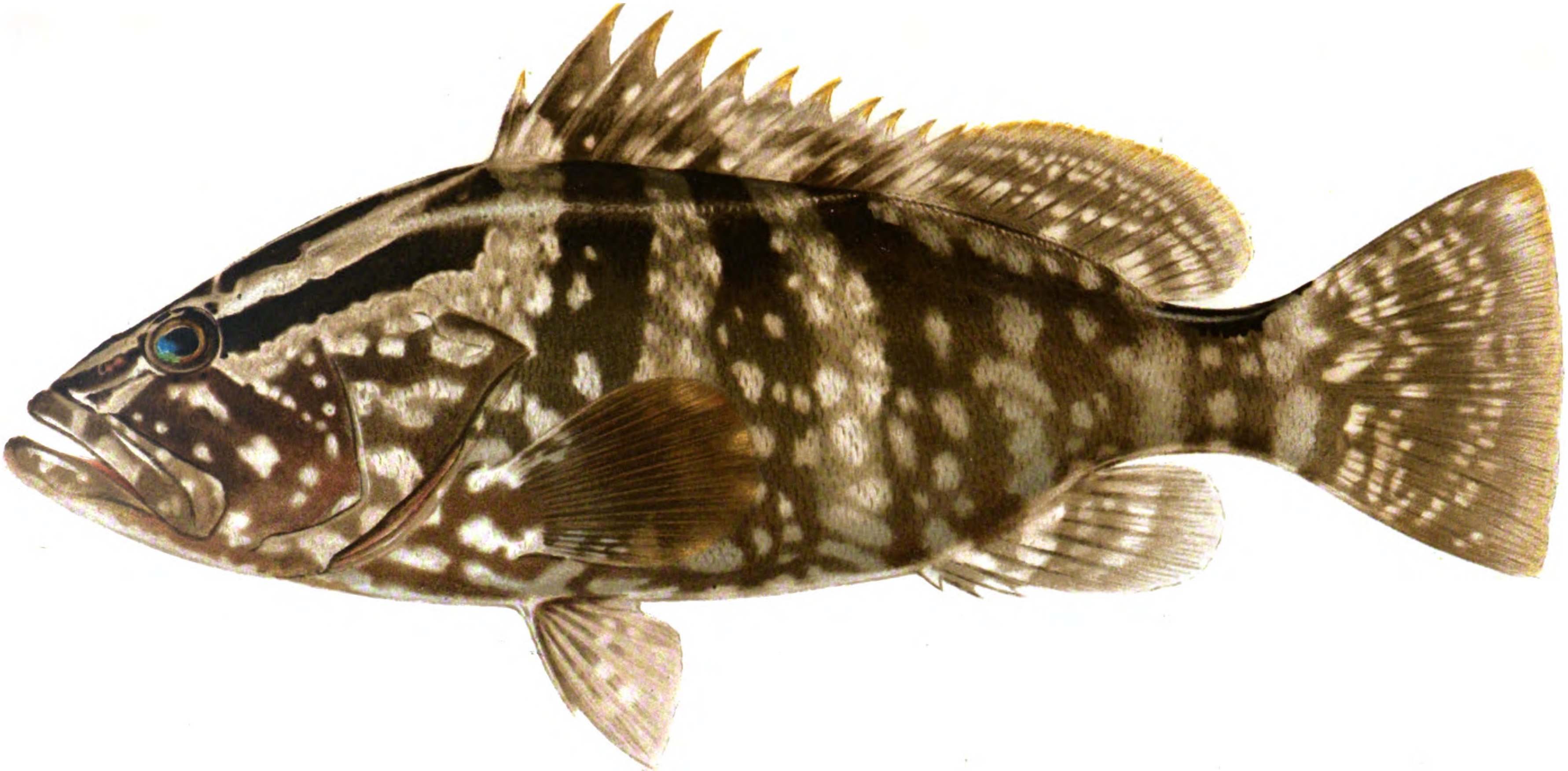


C. B. Hudson ad nat. del.

JULIUS BIEN & CO LITH. N.Y.

EPINEPHELUS ADSCENSIONIS (OSBECK). ROCK HIND; CABRA MORA.

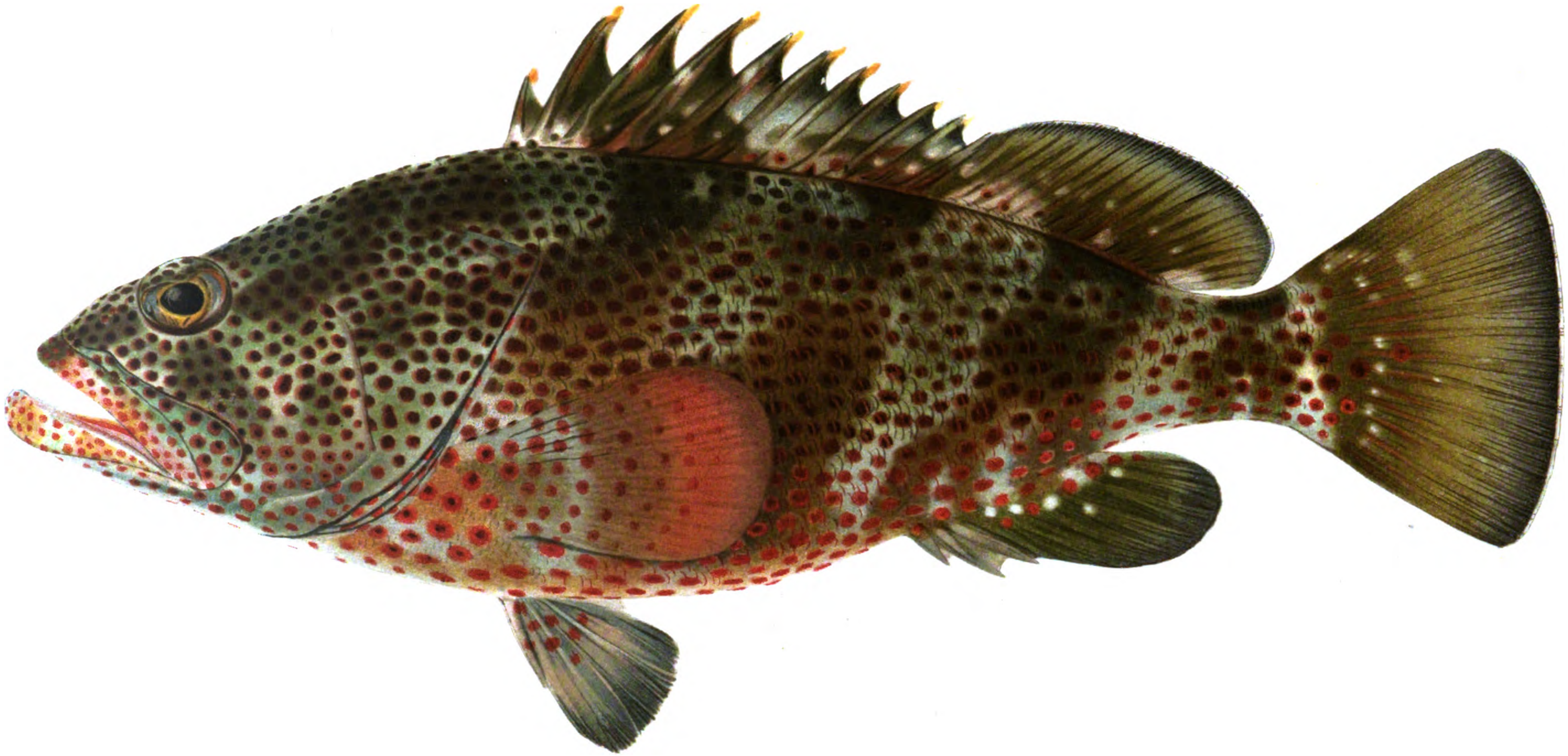
ABOUT THREE-FOURTHS NATURAL SIZE.



C.B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

EPINEPHELUS STRIATUS (BLOCH). NASSAU GROUPER; CHERNA.
ABOUT THREE-FOURTHS NATURAL SIZE.



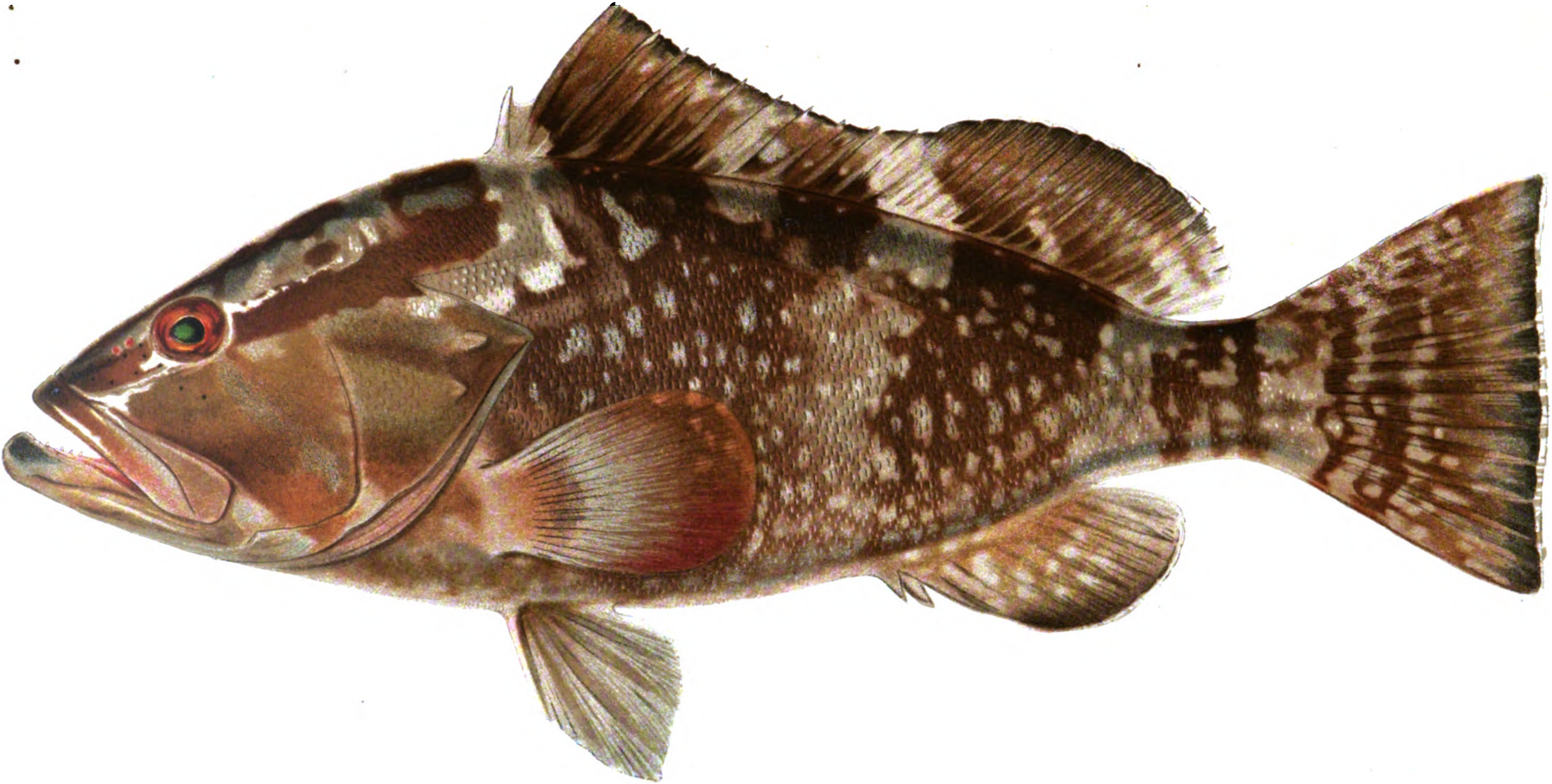
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

EPINEPHELUS MACULOSUS* (CUVIER & VALENCIENNES). RED HIND; CABRILLA.

ABOUT THREE-FIFTHS NATURAL SIZE.

PLATE 14.



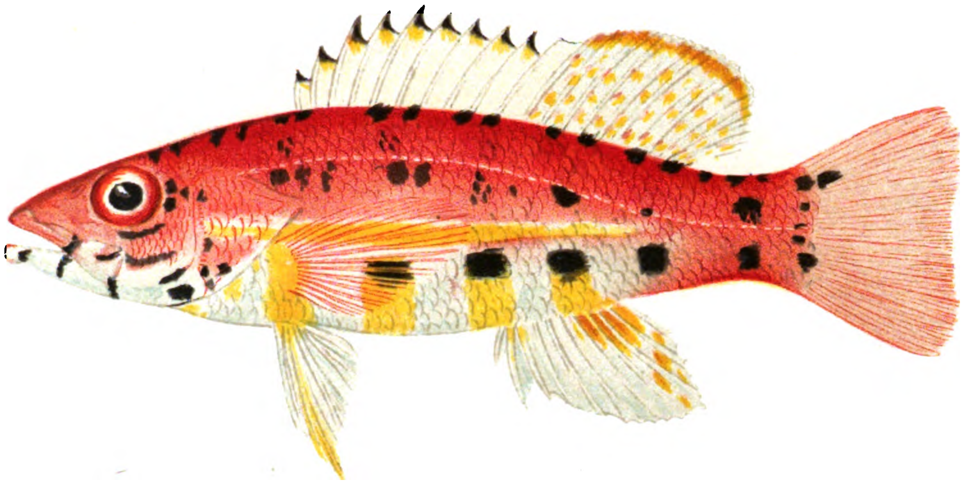
C.B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

EPINEPHELUS MORIO (CUVIER & VALENCIENNES). RED GROUPER; MERO.

NEARLY HALF NATURAL SIZE.

PLATE 15.

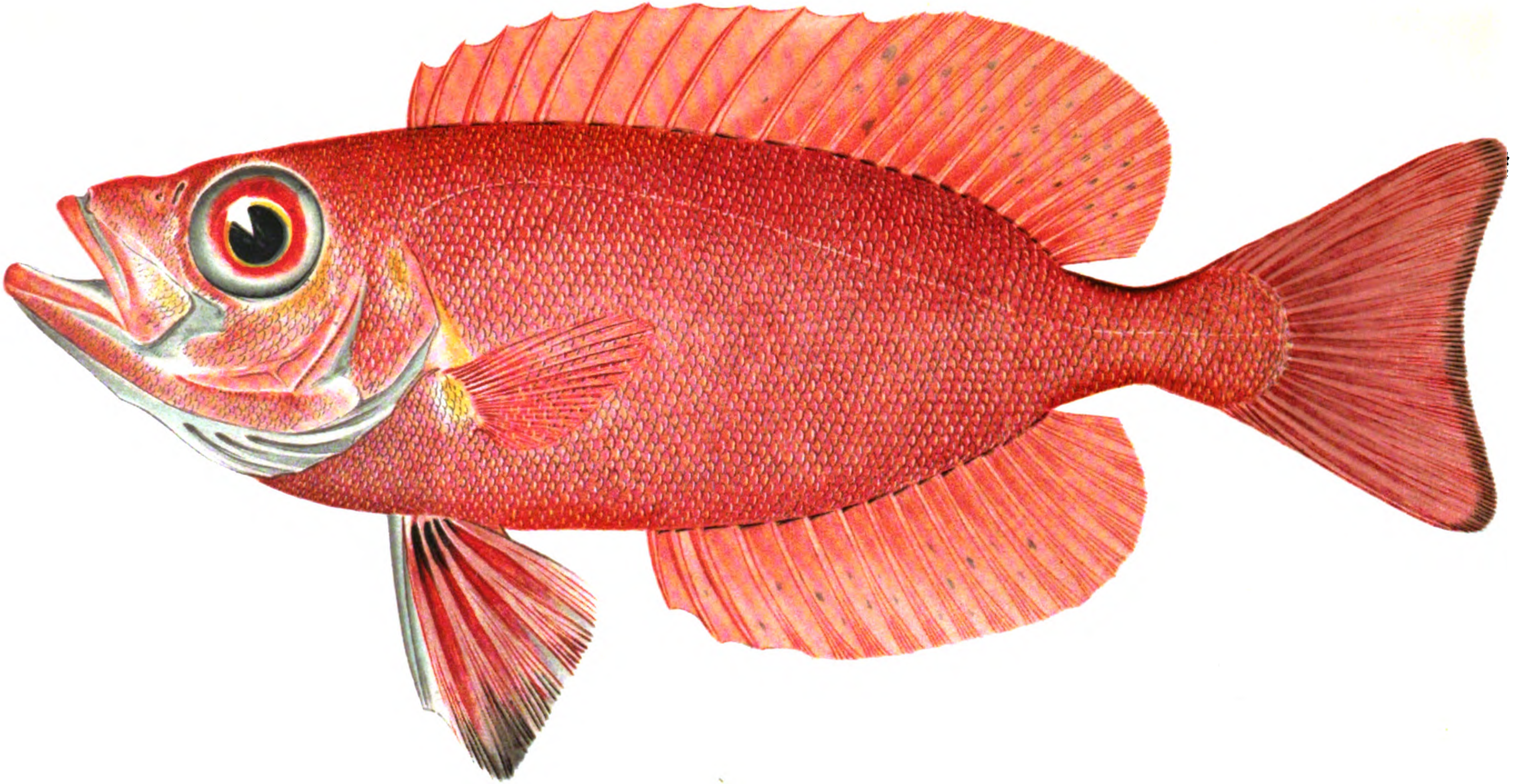


A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

PRIONODES BALDWINI EVERMANN & MARSH. TYPE.

ABOUT 2½ TIMES NATURAL SIZE.

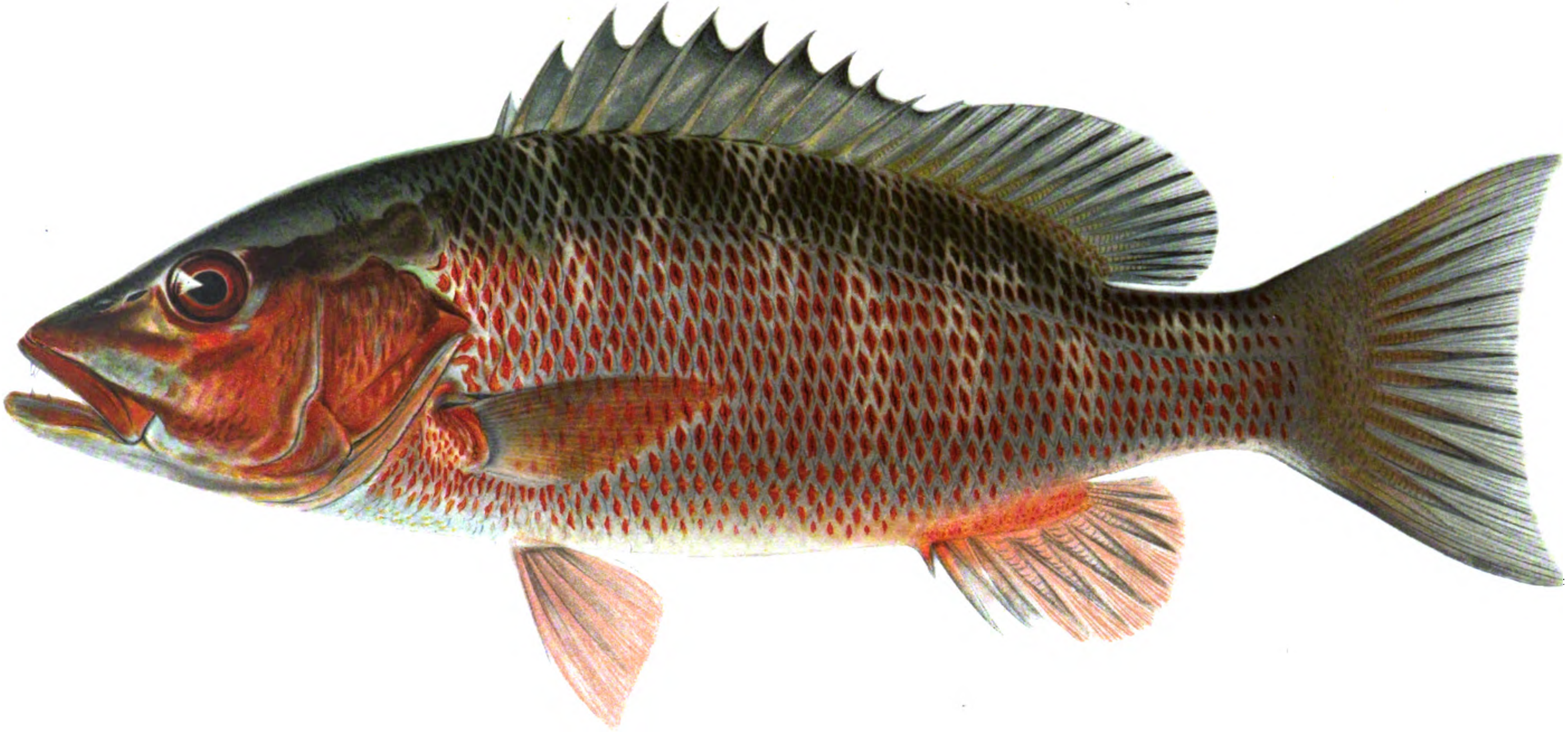


A.H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

Priacanthus arenatus Cuvier & Valenciennes. Catalufa, Toro.

ABOUT NINE-ELEVENTHS NATURAL SIZE.

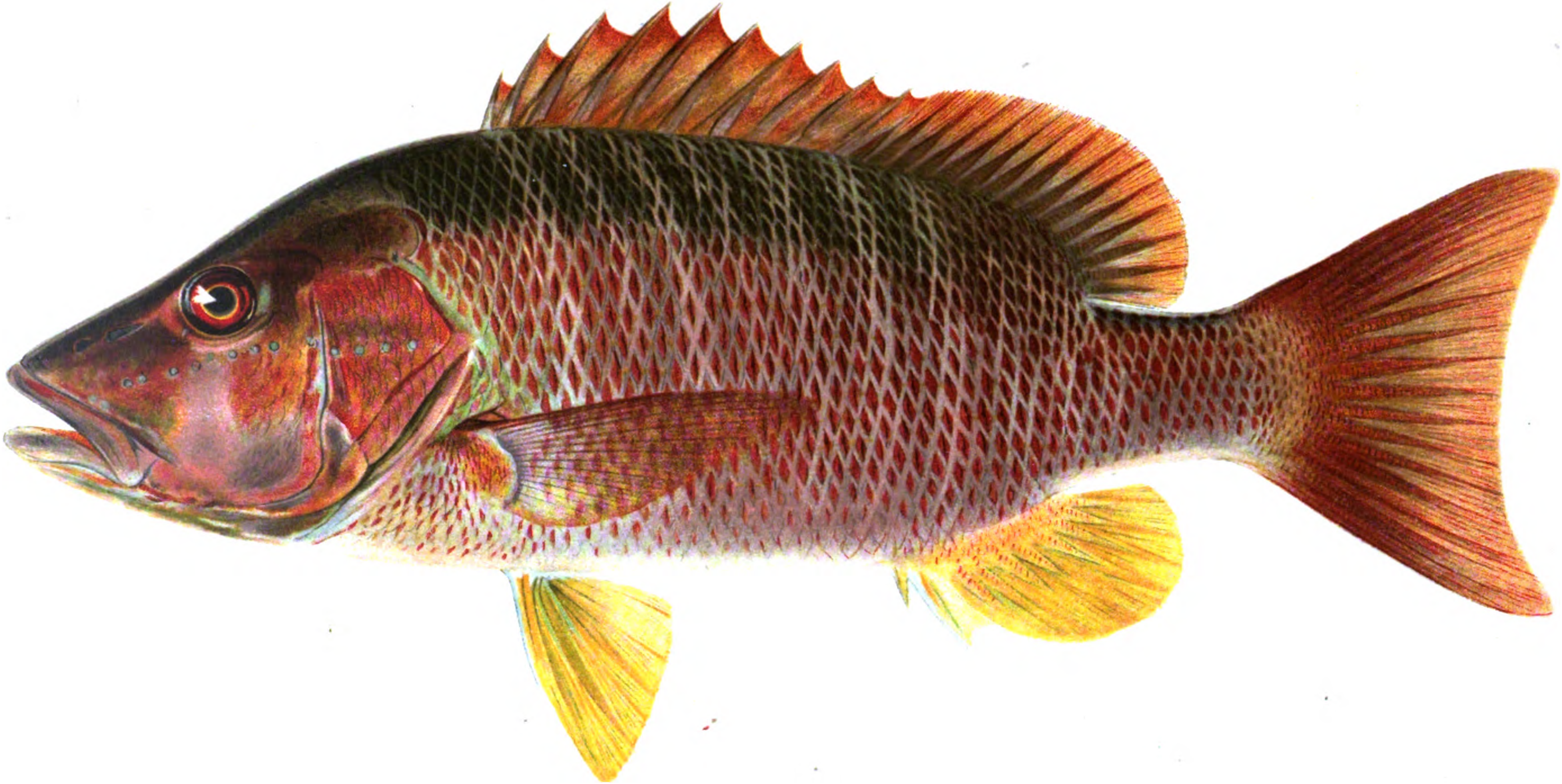


C.B. Hudson ad nat. del.

JULIUS BIEN & CO LITH N Y

NEOMÆNIS GRISEUS (LINNÆUS). GRAY SNAPPER; PARGO PRIETO.
ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 18.



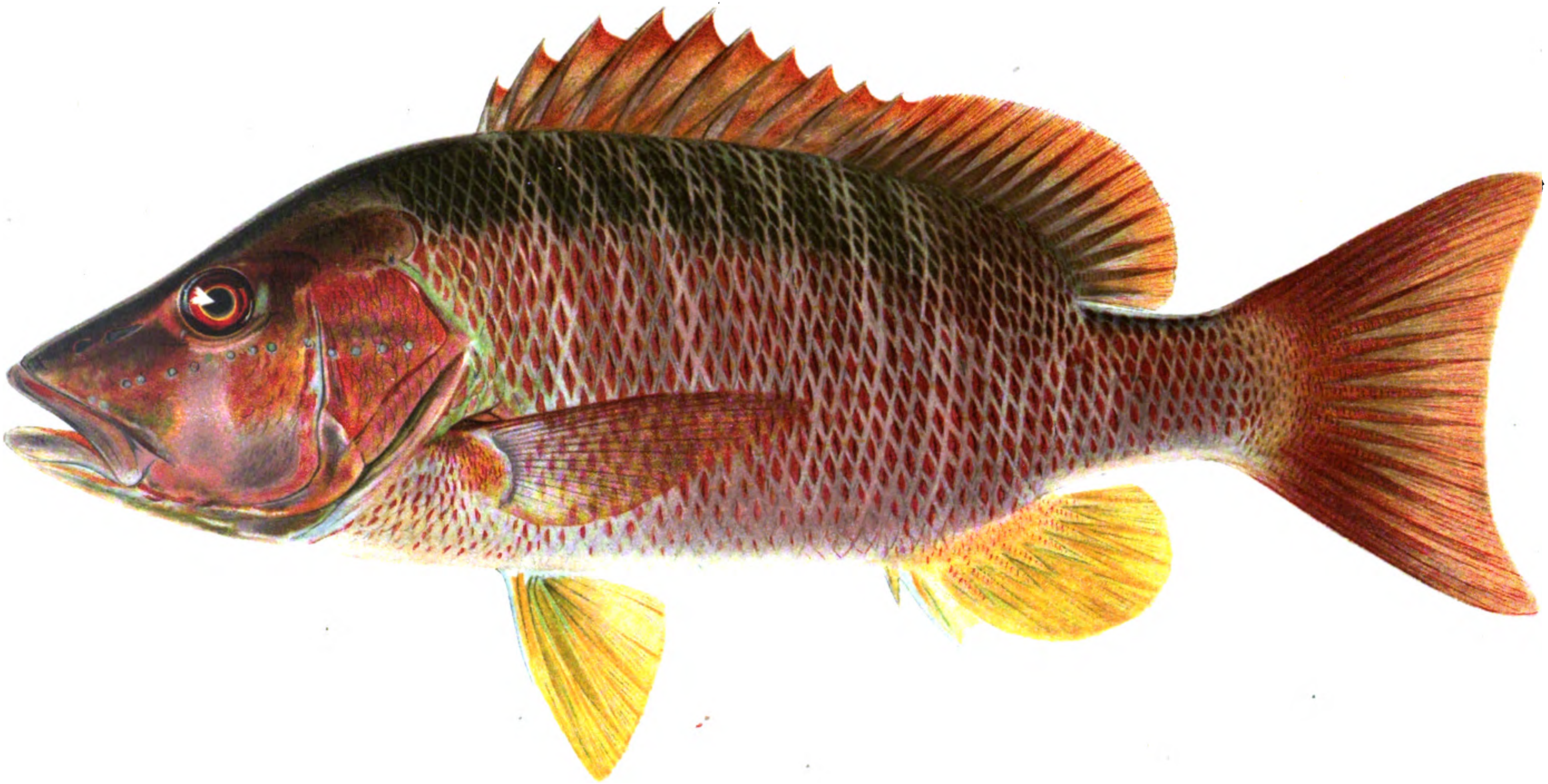
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

NEOMÆNIS JOCU (BLOCH & SCHNEIDER). DOG SNAPPER; JOCÚ.

ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 18.



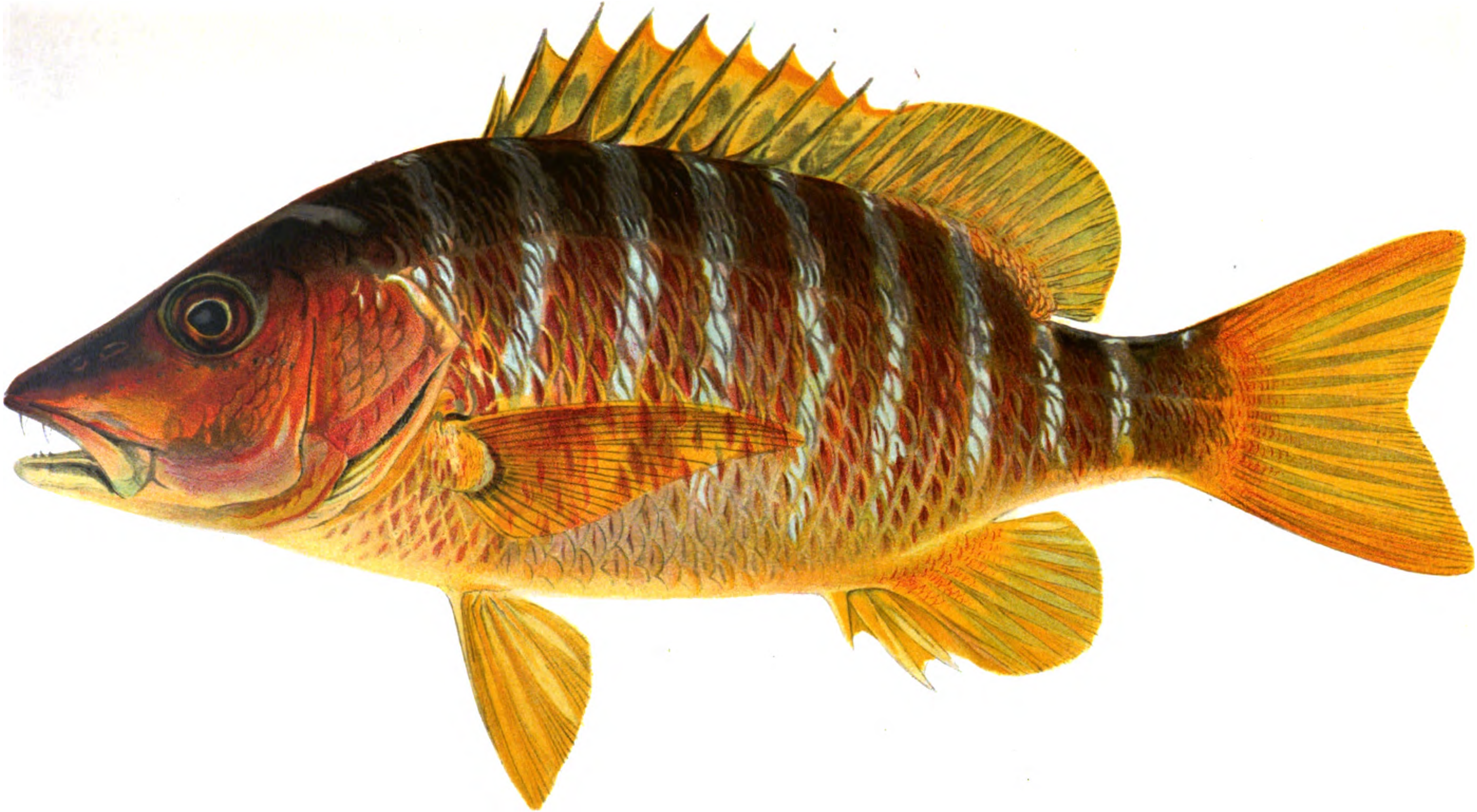
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

NEOMÆNIS JOCU (BLOCH & SCHNEIDER). DOG SNAPPER; JOCÚ.

ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 19.



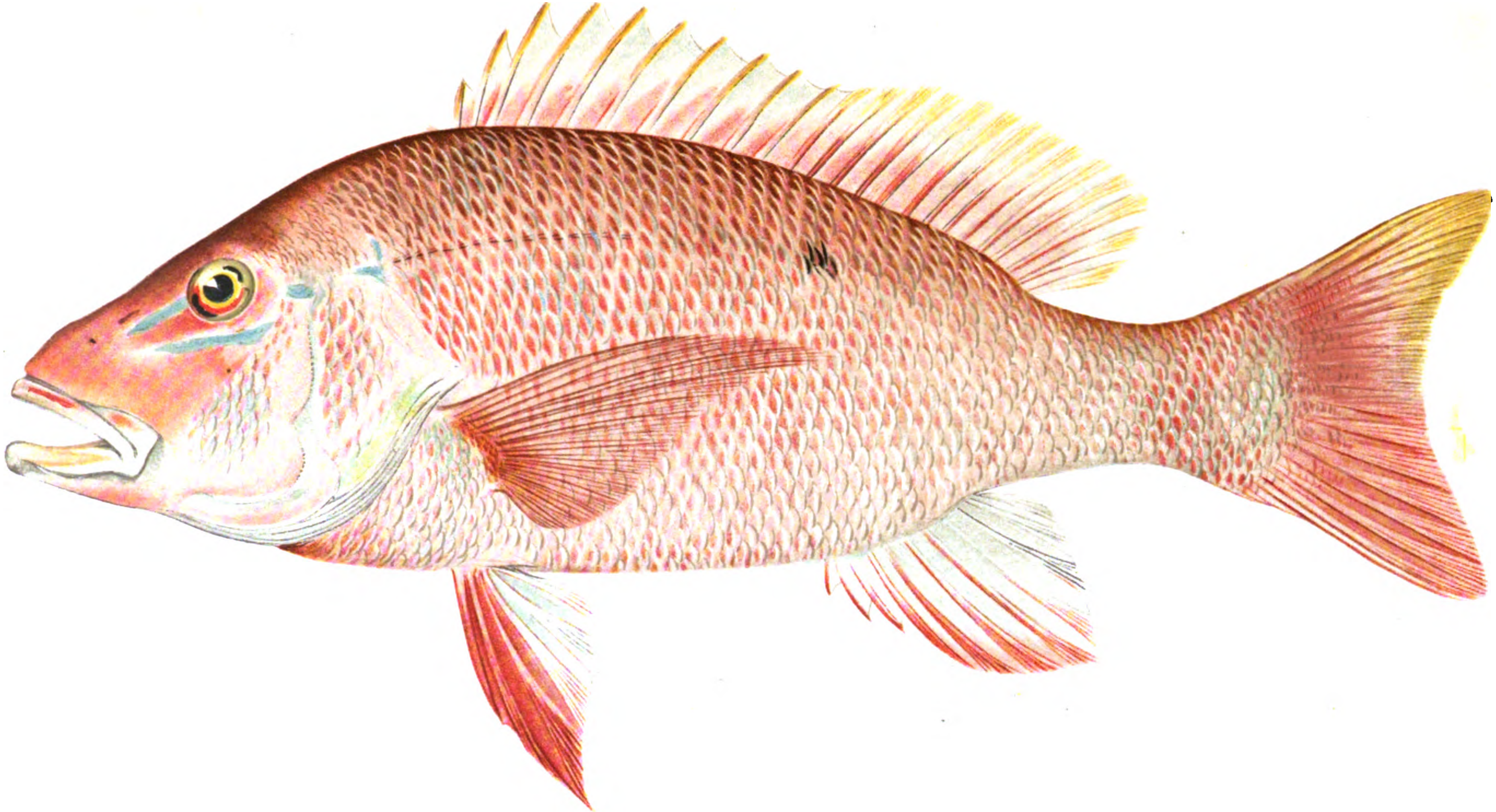
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

NEOMÆNIS APODUS (WALBAUM). SCHOOLMASTER; CAJI.

ABOUT FOUR-FIFTHS NATURAL SIZE.

Plate 20.



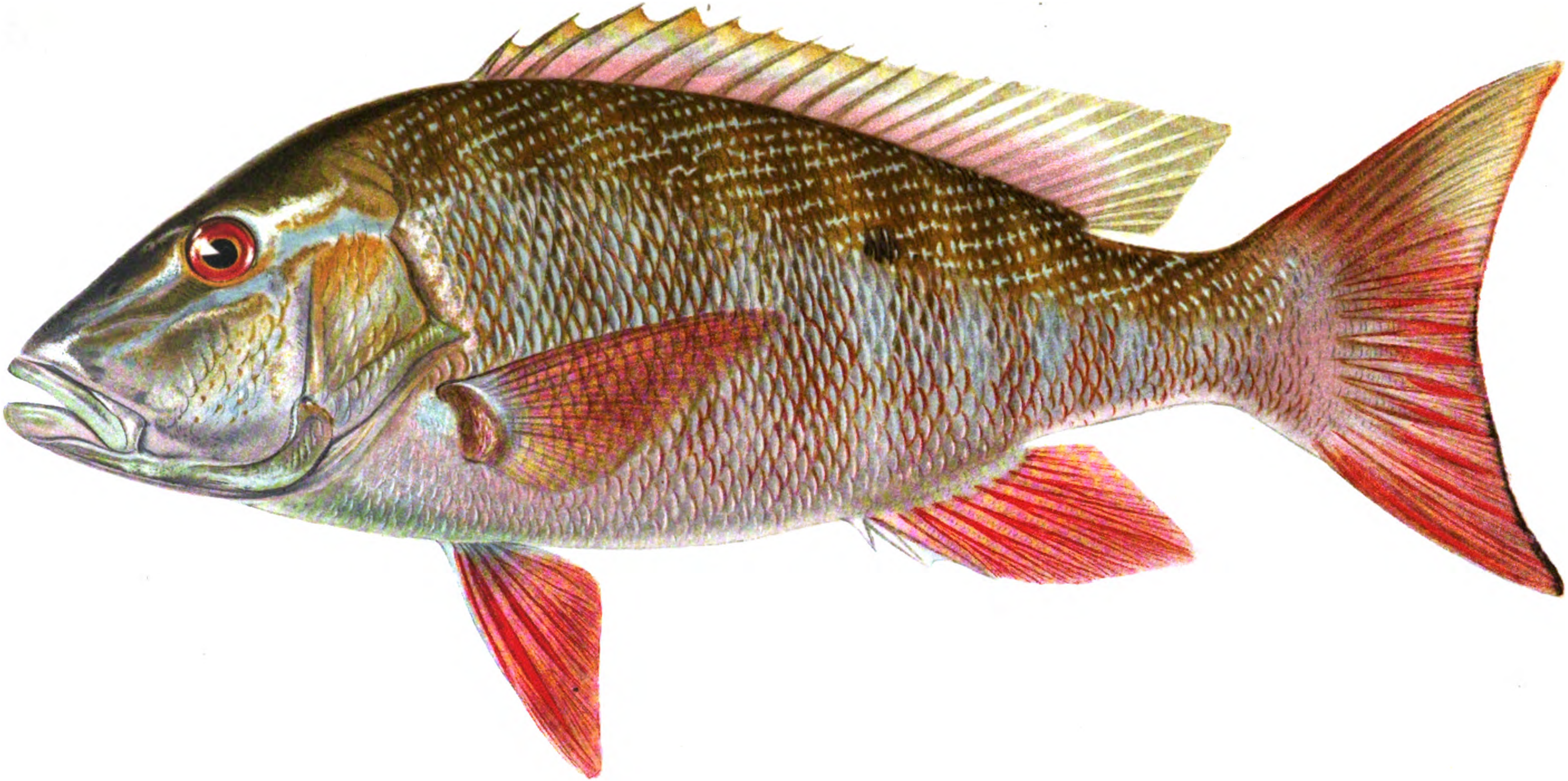
A H. Baldwin ad nat. del.

Julius Bien & Co. Lith N.Y.

Neomænis aya (Bloch). Red Snapper; Pargo Colorado.

About three-sevenths natural size.

PLATE 21.



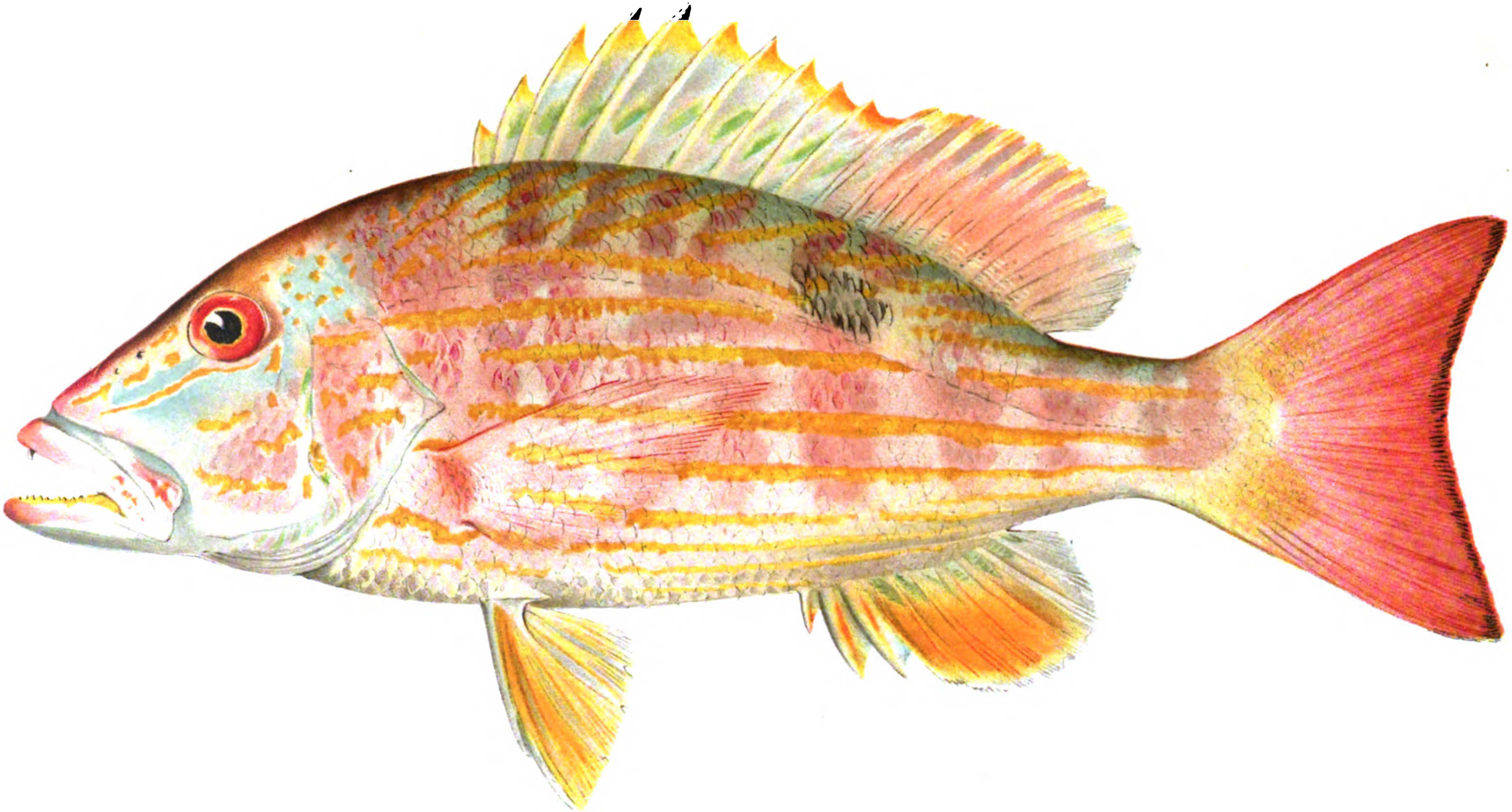
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

NEOMÆNIS ANALIS (CUVIER & VALENCIENNES). MUTTON-FISH; PARGO.

ABOUT TWO-FIFTHS NATURAL SIZE.

PLATE 22.



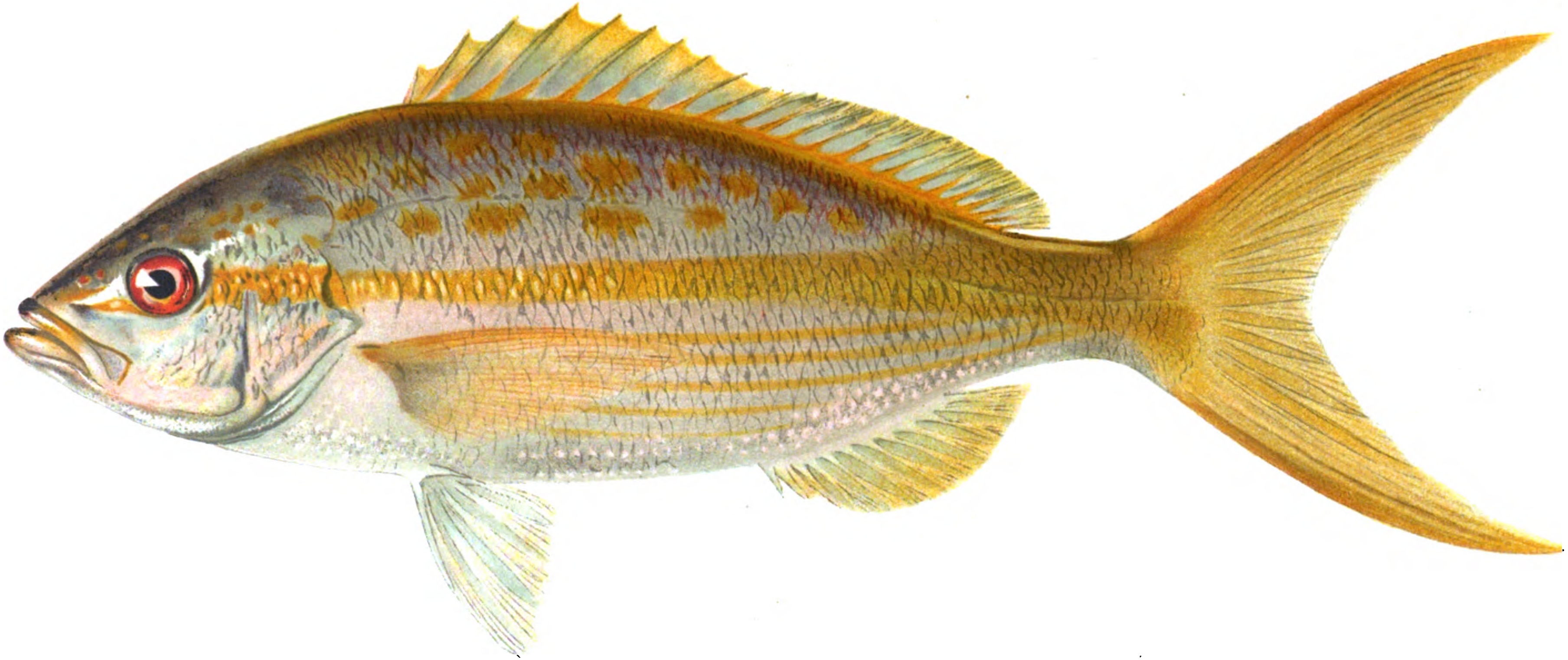
A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

NEOMÆNIS SYNAGRIS (LINNÆUS). LANE SNAPPER.

ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 23.

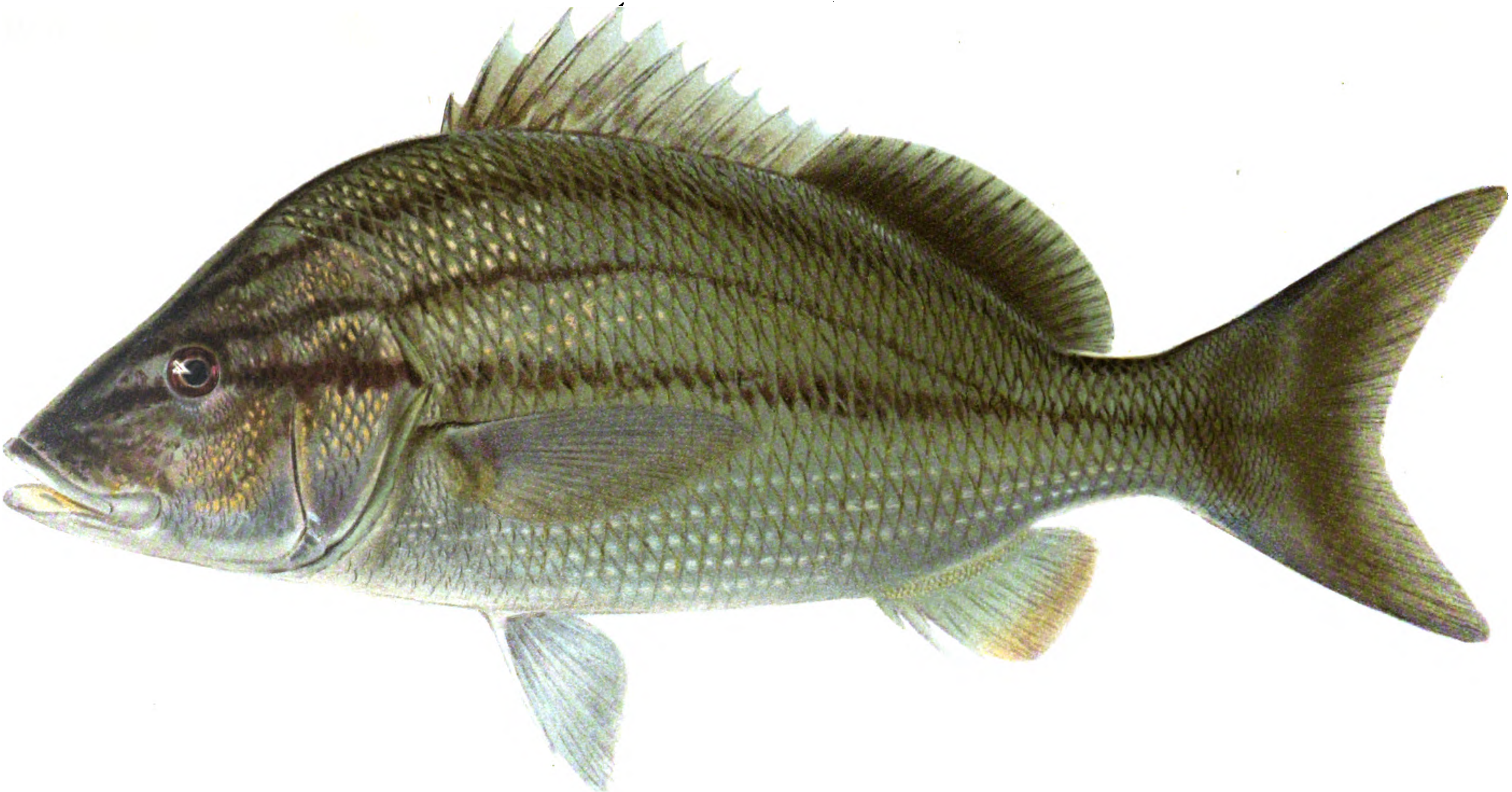


C.B. Hudson ad nat. del.

JULIUS BIEN & CO LITH N.Y.

OCYURUS CHRYSURUS (BLOCH). YELLOW-TAIL; RABIRUBIA; COLORUBIA.
ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 24.



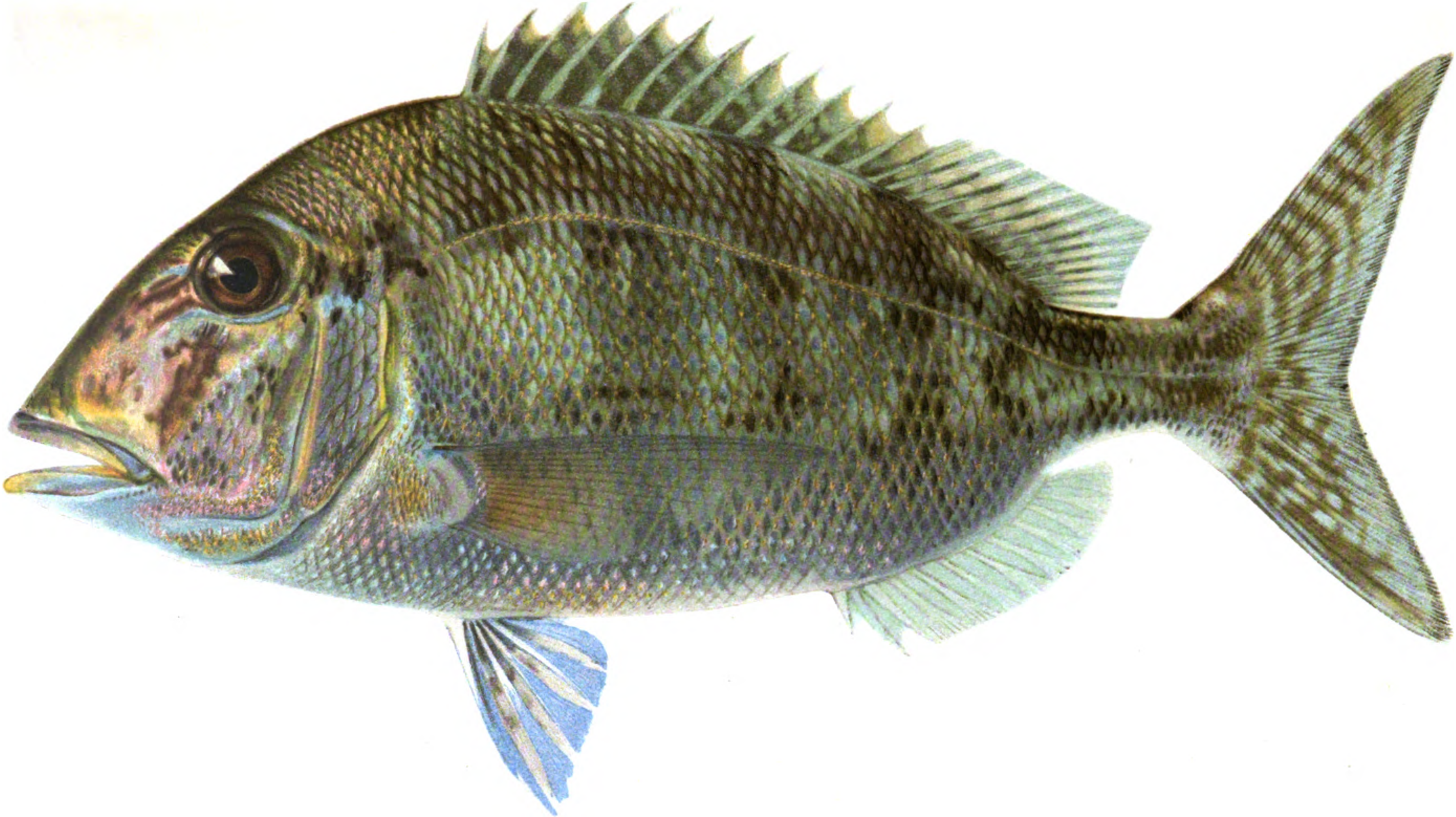
C. B. Hudson ad nat. del.

JULIUS BIEN & CO. LITH N Y

HÆMULON ALBUM CUVIER & VALENCIENNES. MARGATE-FISH.

ABOUT THREE-SEVENTHS NATURAL SIZE.

PLATE 25.

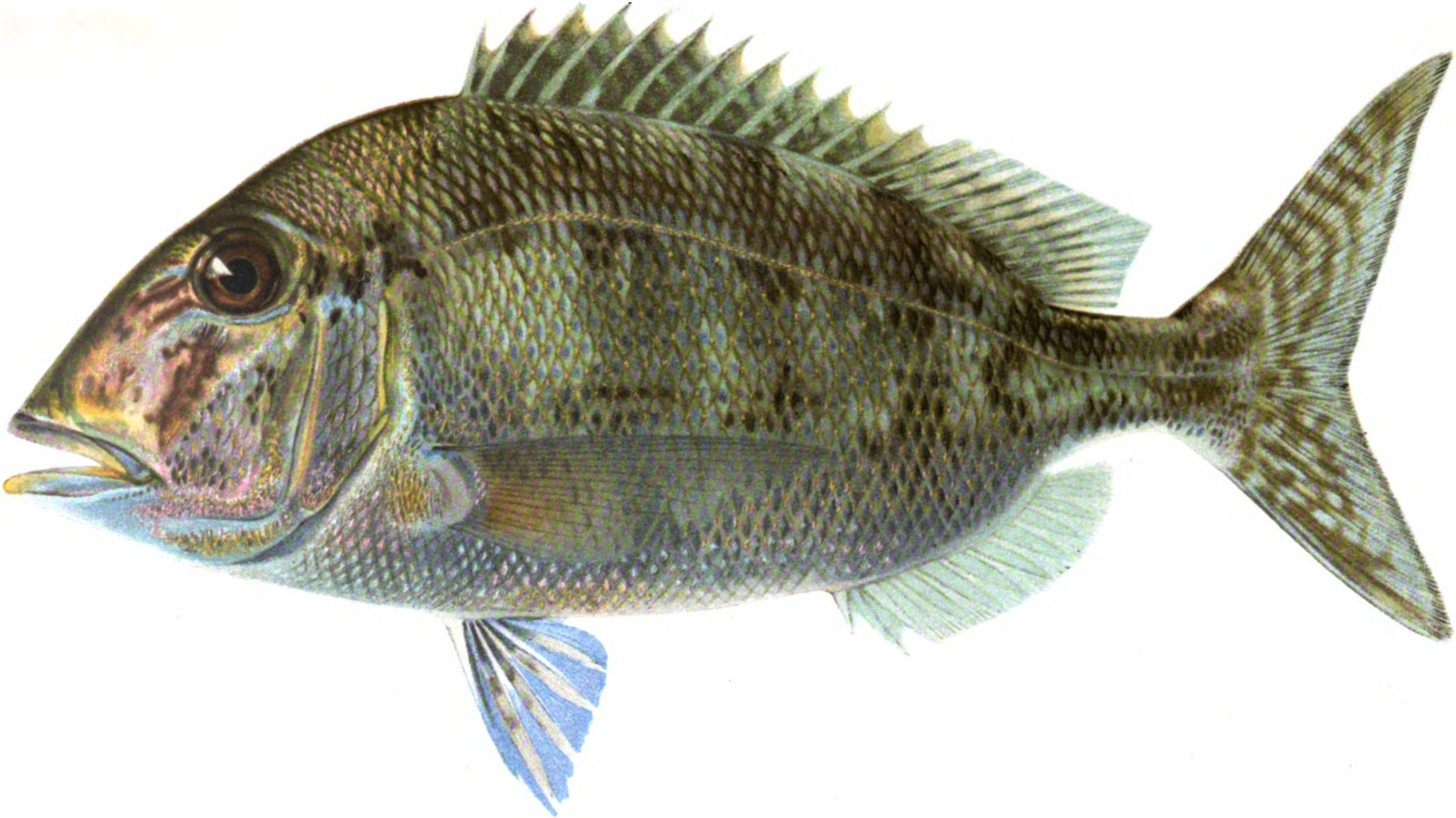


C. B. Hudson ad nat del.

JULIUS BIEN & CO LITH N.Y.

CALAMUS BAJONADO (BLOCH & SCHNEIDER). JOLT-HEAD PORGY; PLUMA.
ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 25.

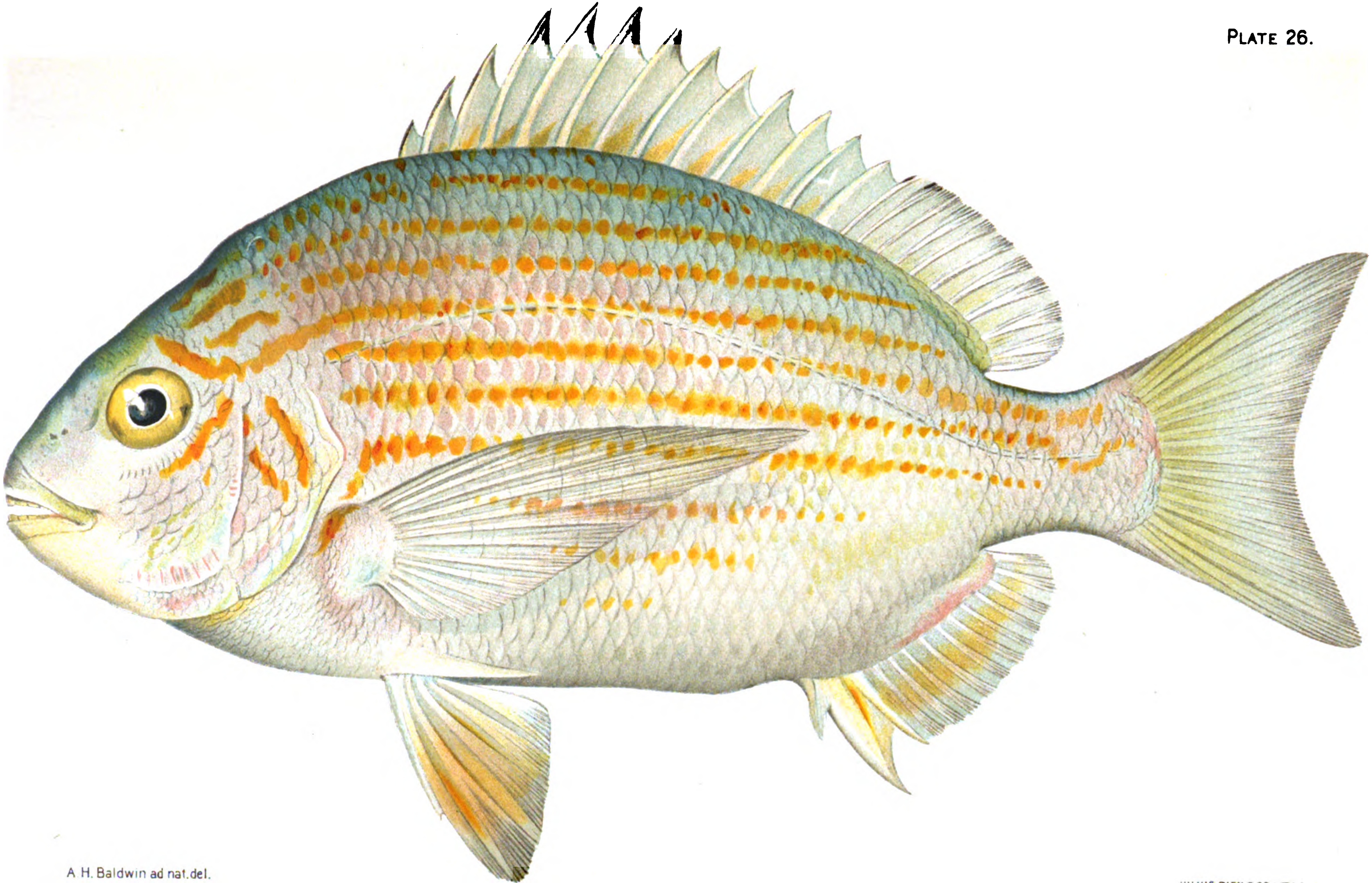


C. B. Hudson ad nat del.

JULIUS BIEN & CO LITH N.Y.

CALAMUS BAJONADO (BLOCH & SCHNEIDER). JOLT-HEAD PORGY; PLUMA.
ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 26.



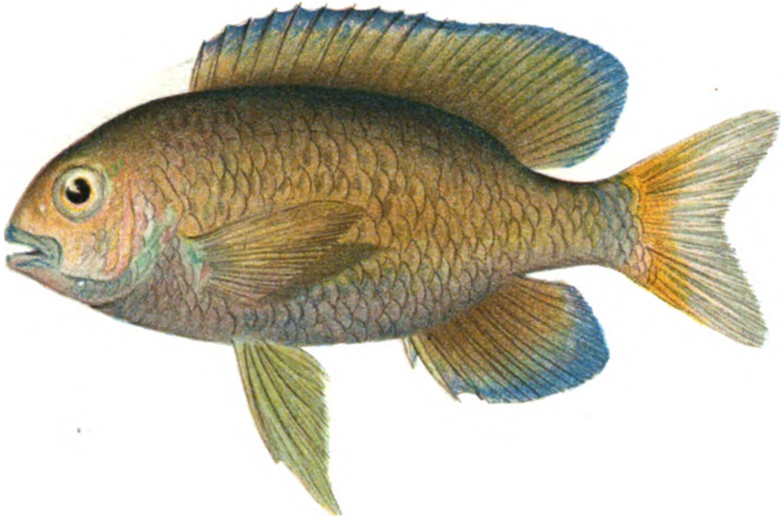
A. H. Baldwin ad nat. del.

ARCHOSARGUS UNIMACULATUS (BLOCH).

NATURAL SIZE.

JULIUS BIEN & CO. LITH. N. Y.

PLATE 27.

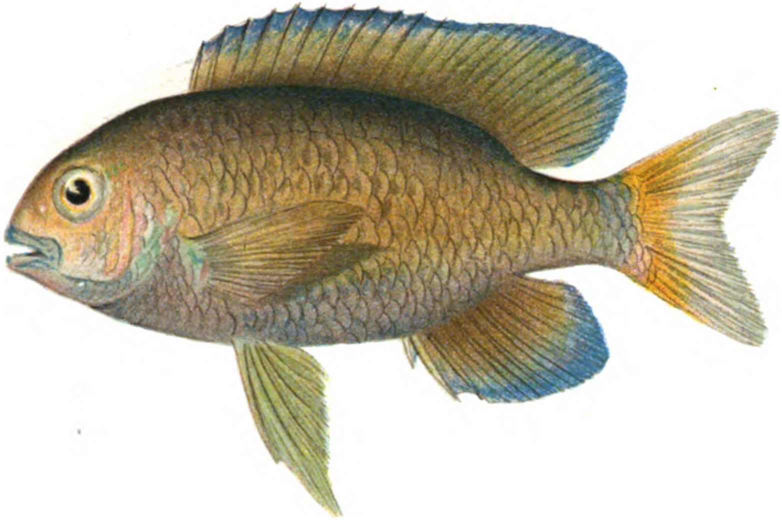


A. H. Baldwin ad nat. del.

JULIUS BIEN & CO LITH N.Y.

EUPOMACENTRUS FUSCUS (CUVIER & VALENCIENNES).

ABOUT 1½ TIMES NATURAL SIZE.



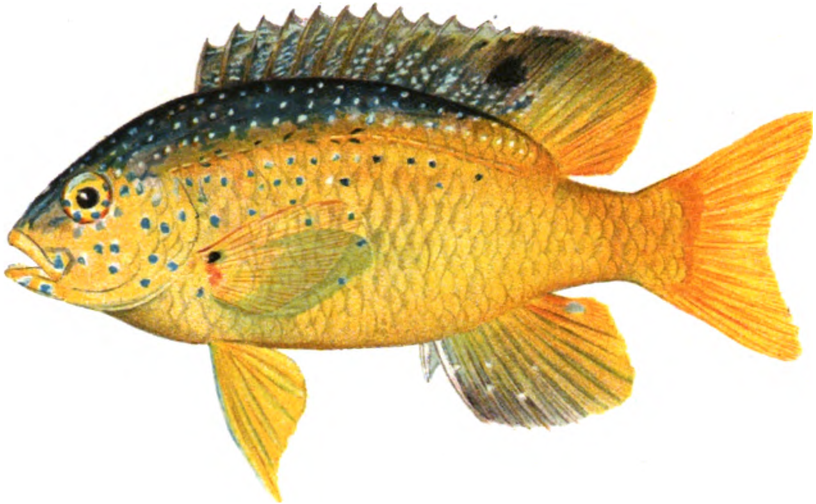
A H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH N Y

EUPOMACENTRUS FUSCUS (CUVIER & VALENCIENNES).

ABOUT 1½ TIMES NATURAL SIZE.

PLATE 28.

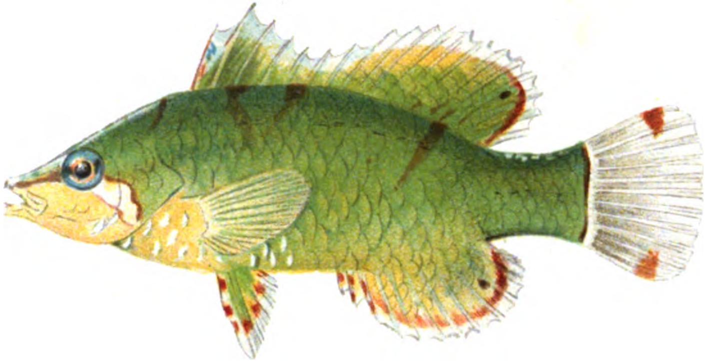


A.H. Baldwin ad nat.del.

JULIUS BIEN & CO LITH N.Y.

EUPOMACENTRUS LEUCOSTICTUS (MÜLLER & TROSCHEL).

NEARLY TWICE NATURAL SIZE.



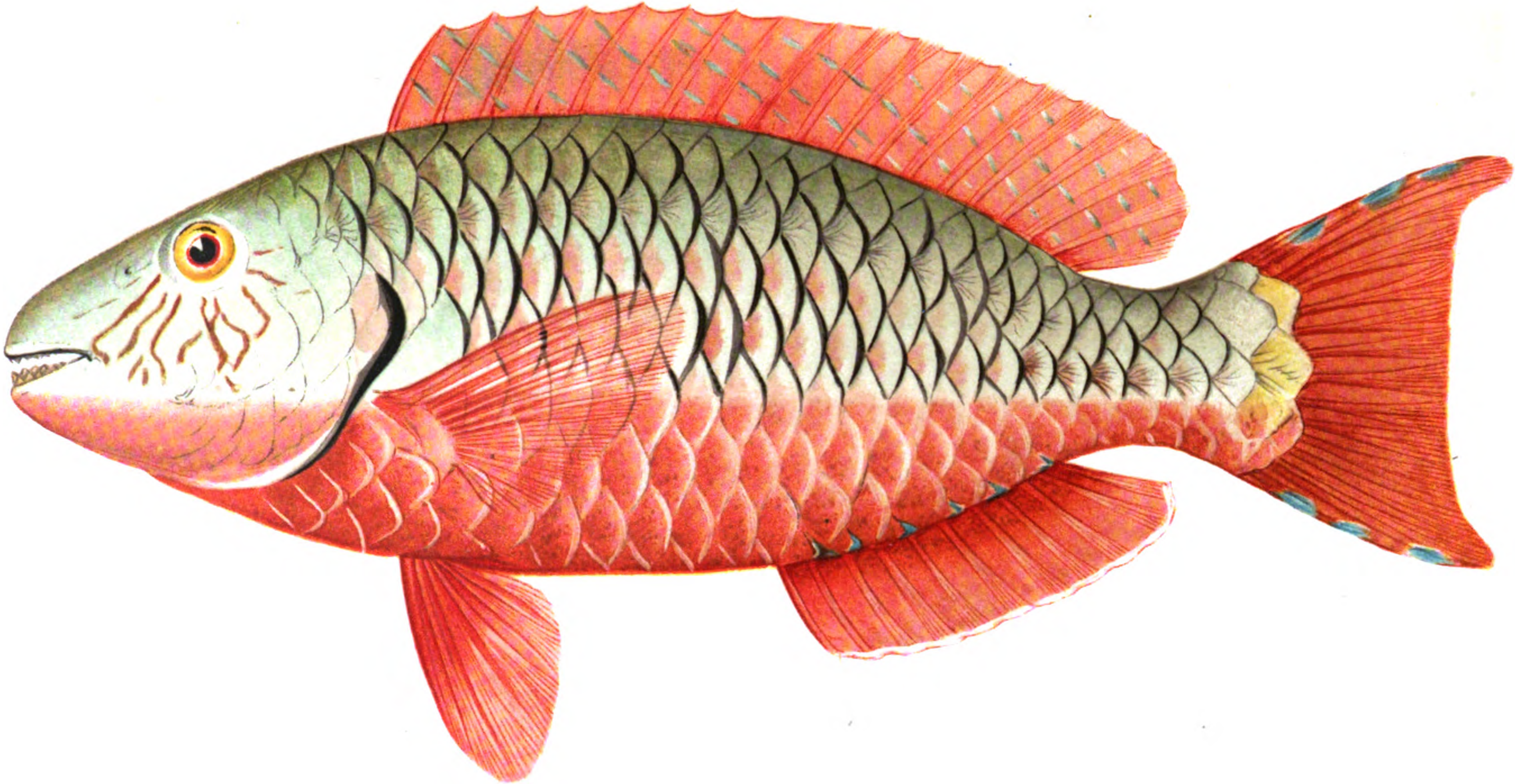
A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

DORATONOTUS DECORIS EVERMANN & MARSH. TYPE.

ABOUT 2½ TIMES NATURAL SIZE.

PLATE 30.



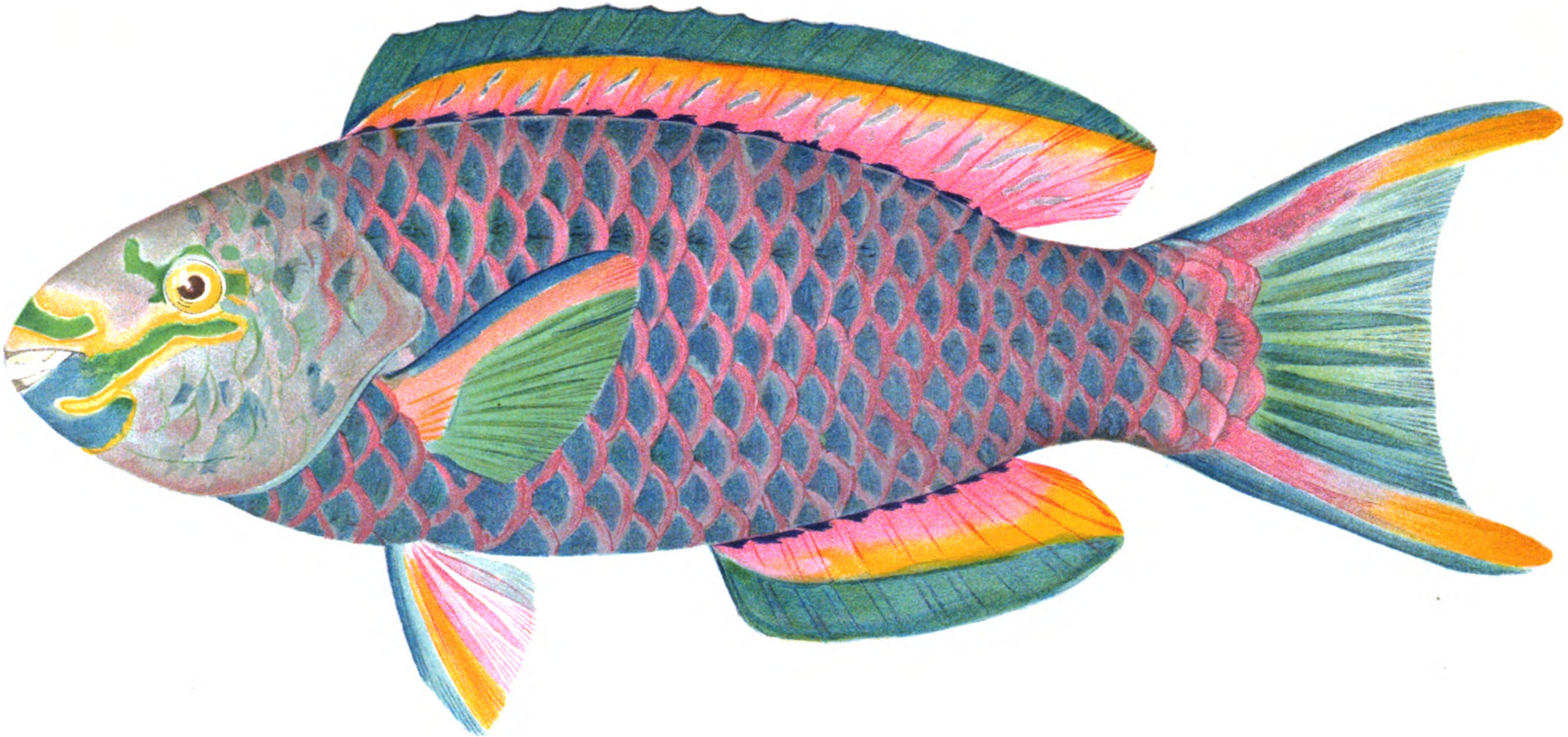
A.H. Baldwin ad nat. del.

JULIUS BIEN & CO LITH N.Y.

SPARISOMA ABILDGAARDI (BLOCH). RED PARROT-FISH; LORO COLORADO.

ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 31.



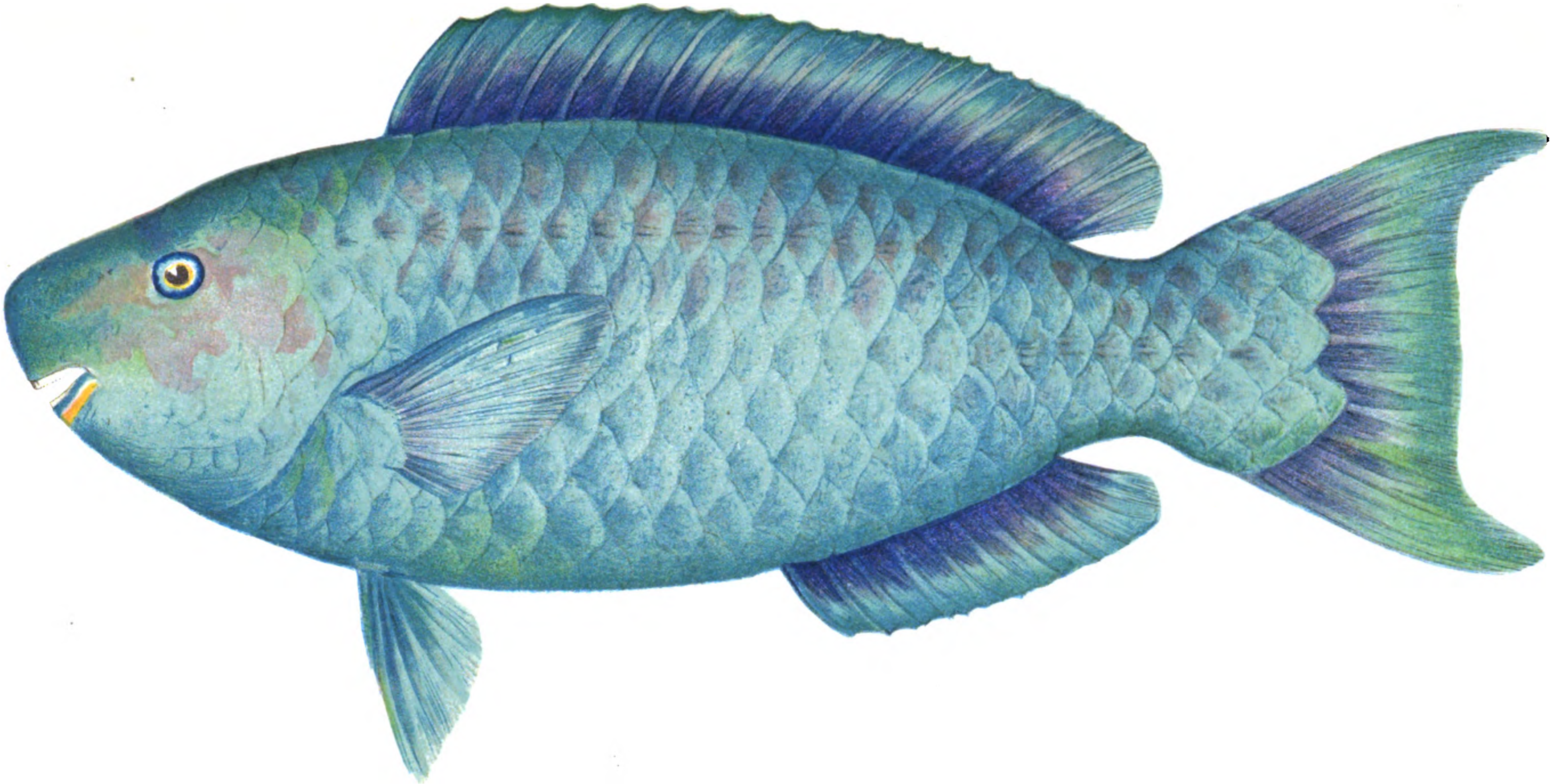
A H Baldwin ad nat del.

JULIUS BIEN & CO. LITH N Y

SCARUS VETULA BLOCH & SCHNEIDER.

ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 32.

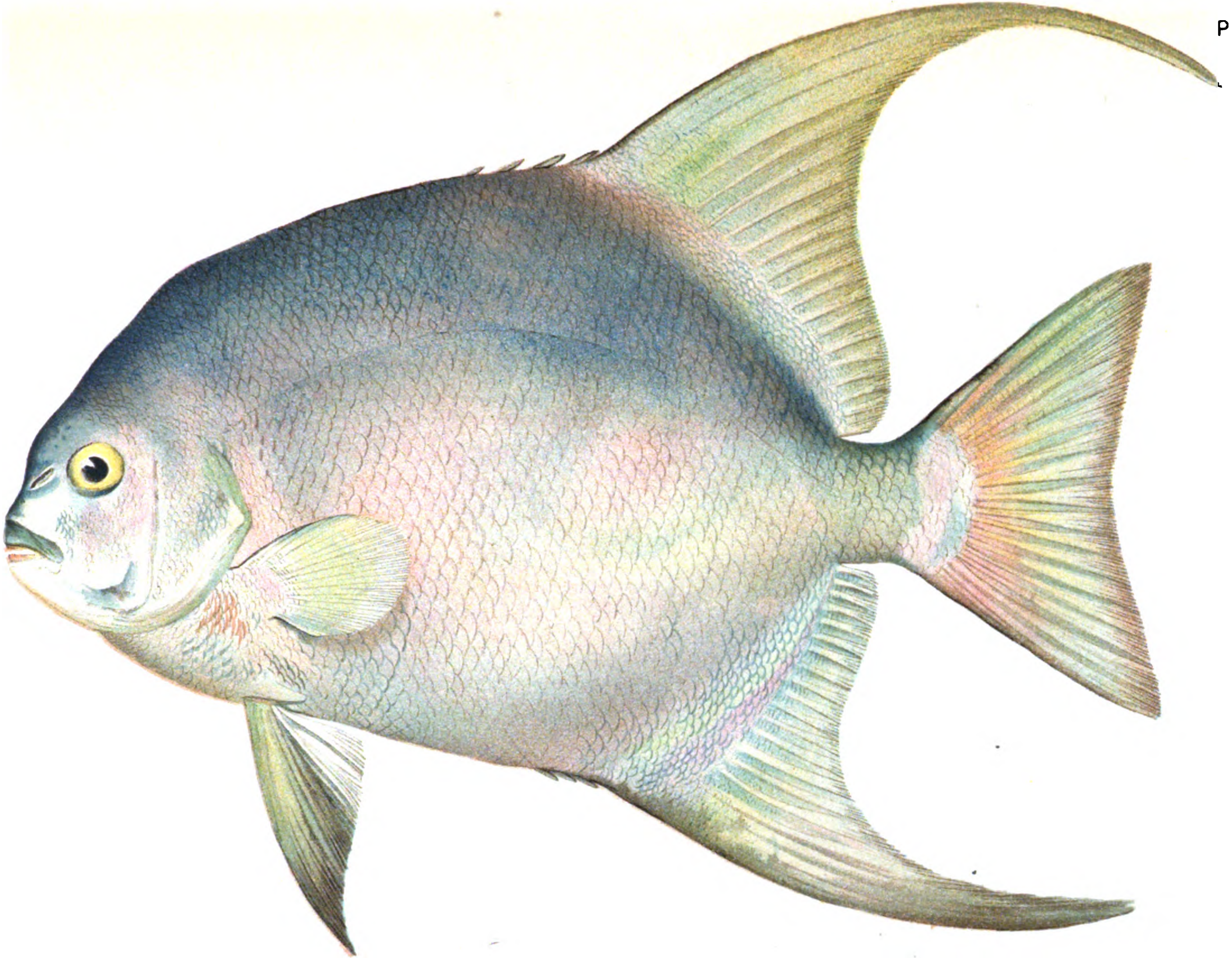


A H Baldwin ad nat del.

JULIUS BIEN & CO LITH. N.Y.

SCARUS CŒRULEUS (BLOCH). BLUE PARROT-FISH; LORO.
ABOUT THREE-FIFTHS NATURAL SIZE.

PLATE 33.

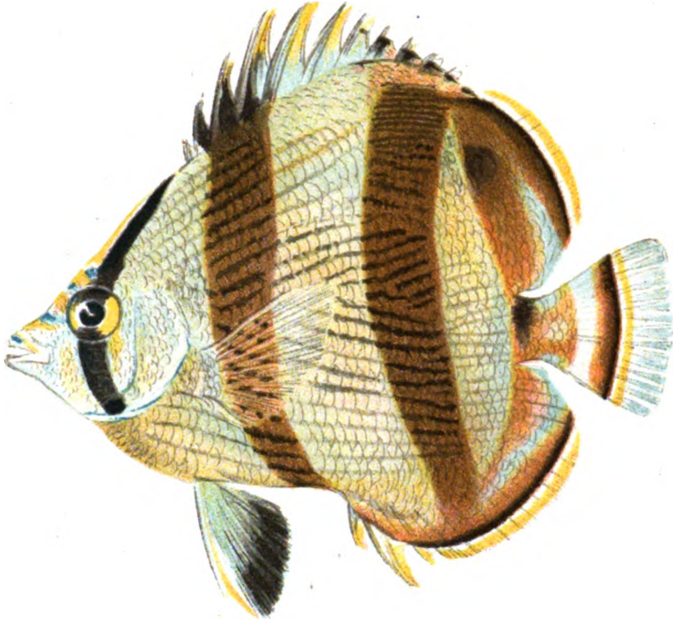


A. H. Baldwin ad nat. del.

JULIUS BIEN & CO LITH N Y

CHÆTODIPTERUS FABER (BROUSSONET). SPADE-FISH.
ABOUT THREE-FIFTHS NATURAL SIZE.

PLATE 34.



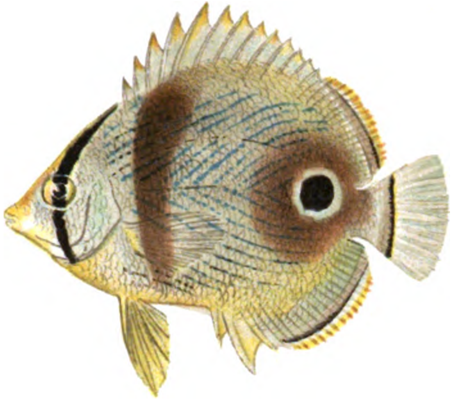
A H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

CHÆTODON STRIATUS LINNÆUS. BUTTERFLY-FISH; MARIPOSA.

NATURAL SIZE.

PLATE 35.

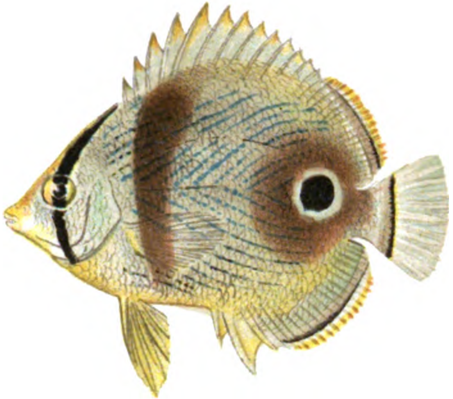


A.H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH N.Y

CHÆTODON CAPISTRATUS LINNÆUS. BUTTERFLY-FISH; MARIPOSA.
NATURAL SIZE.

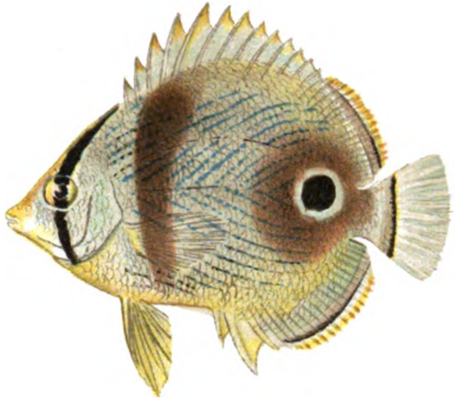
PLATE 35.



A. H. Baldwin ad nat. del.

JULIUS BIEN & CO LITH N.Y.

CHÆTODON CAPISTRATUS LINNÆUS. BUTTERFLY-FISH; MARIPOSA.
NATURAL SIZE.



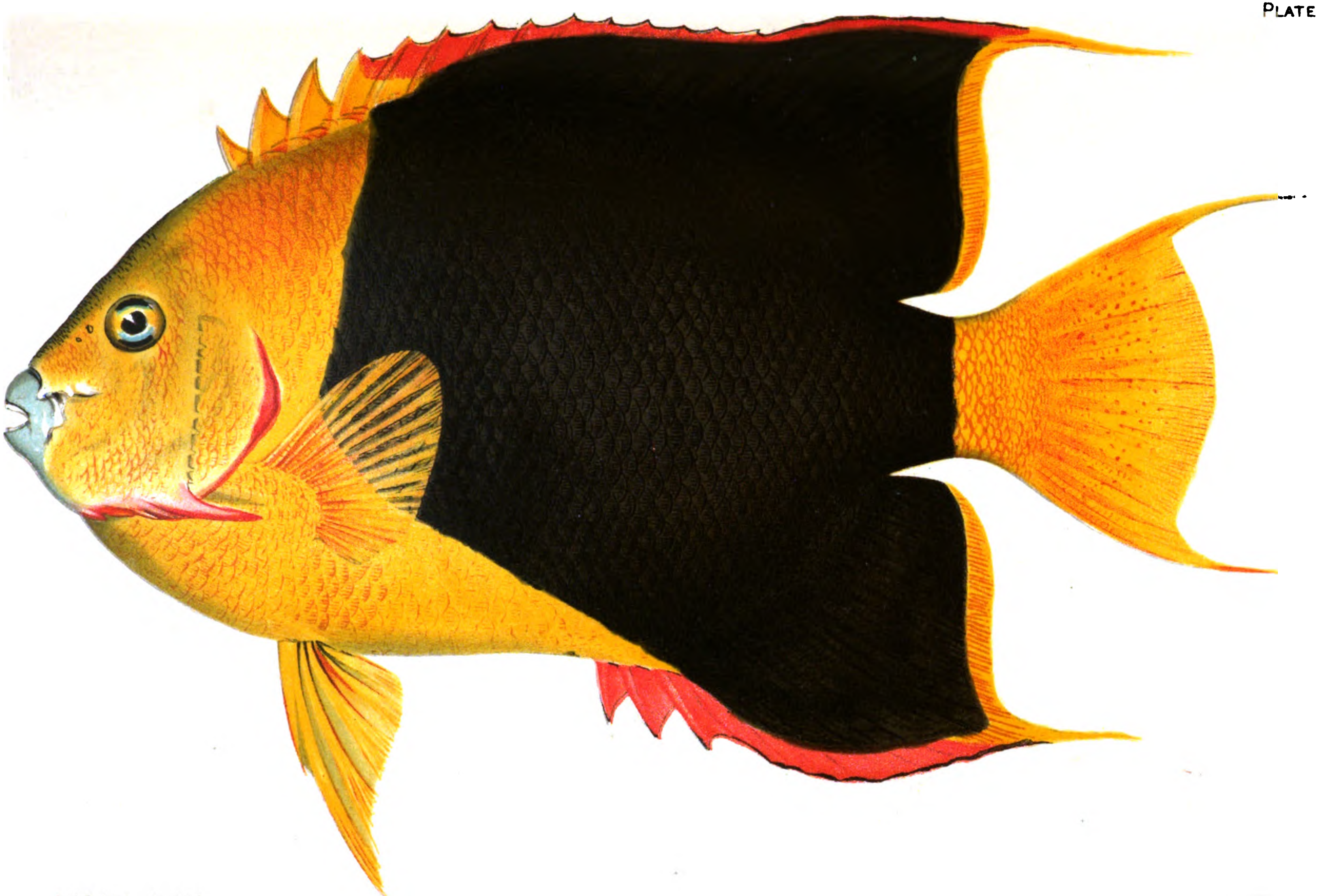
A. H. Baldwin ad nat. del.

JULIUS BIEN & CO LITH N.Y.

CHÆTODON CAPISTRATUS LINNÆUS. BUTTERFLY-FISH; MARIPOSA.

NATURAL SIZE.

PLATE 36.



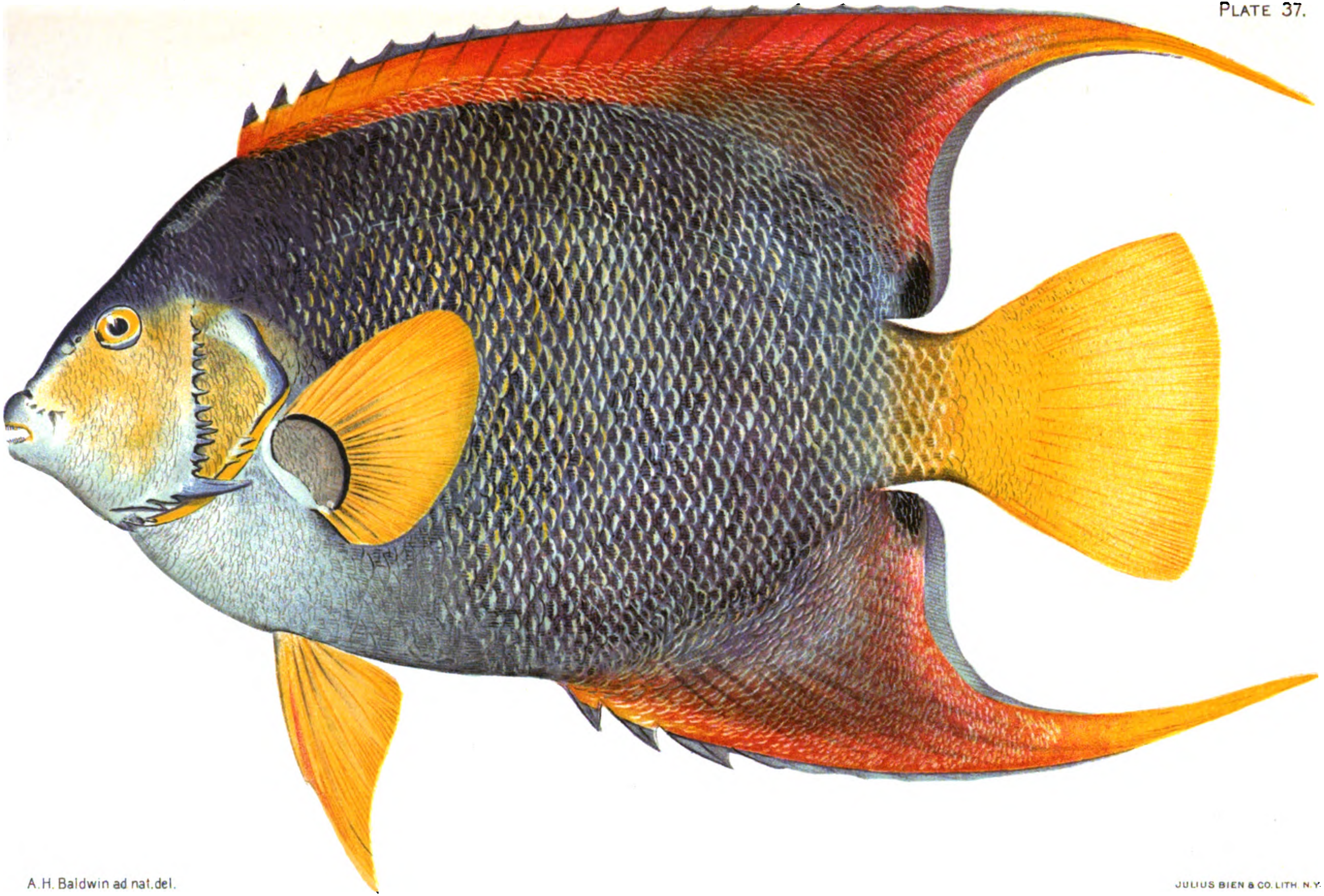
A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

HOLACANTHUS TRICOLOR (BLOCH). ROCK BEAUTY; PALMONETA.

ABOUT $1\frac{2}{7}$ TIMES NATURAL SIZE.

PLATE 37.

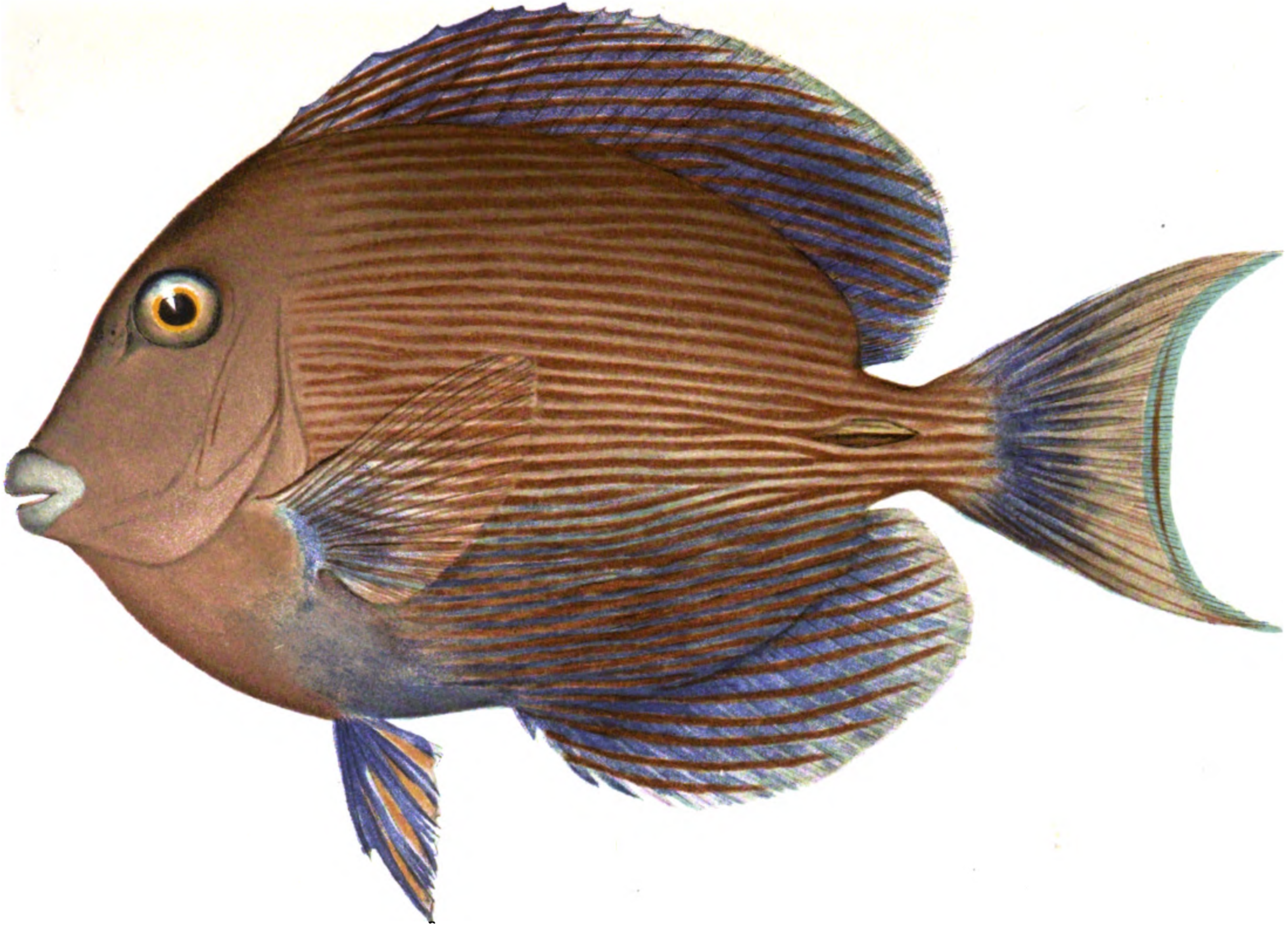


A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

ANGELICHTHYS CILIARIS (LINNÆUS). BLUE ANGEL-FISH, MARIPOSA.
ABOUT THREE-FOURTHS NATURAL SIZE.

PLATE 38.



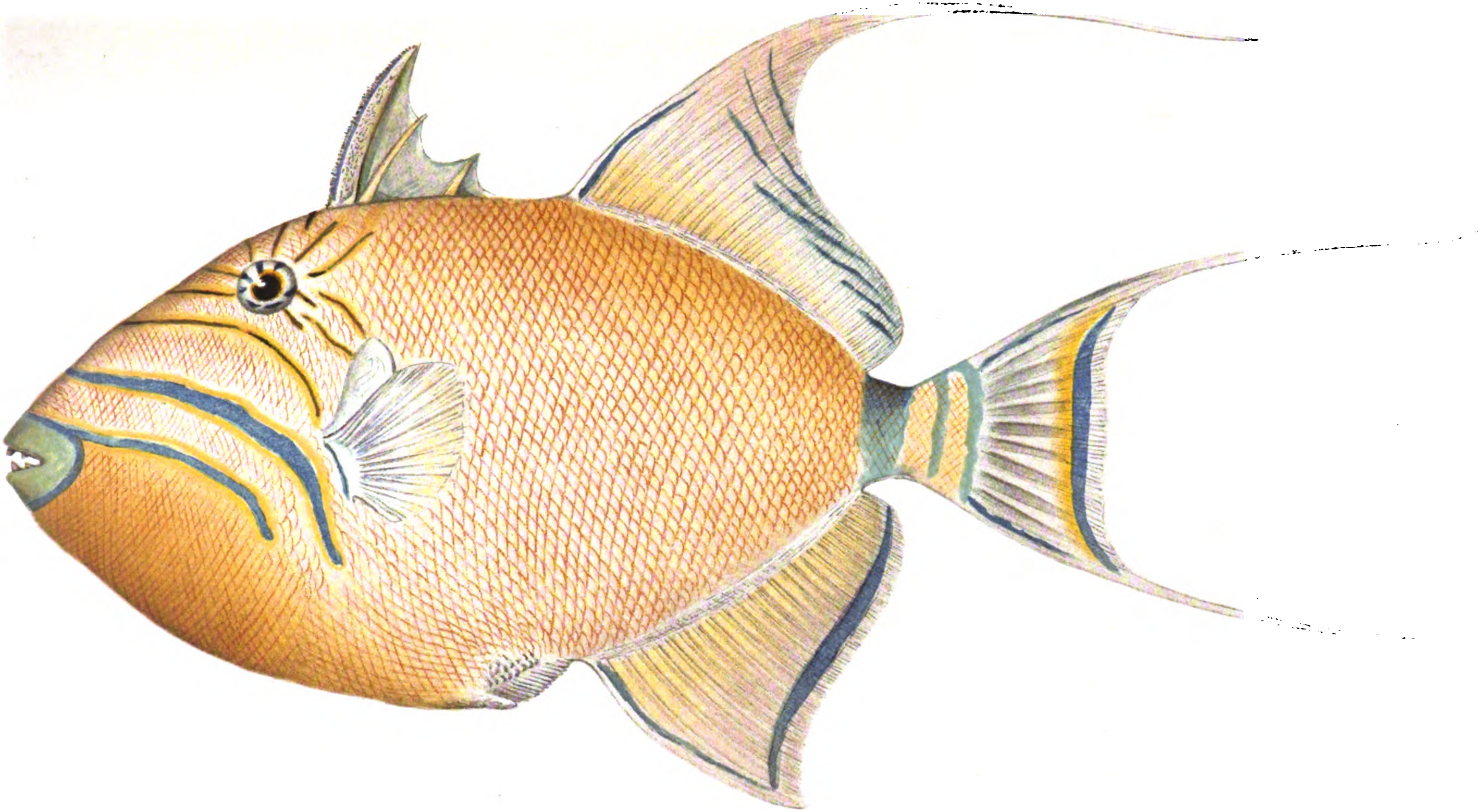
A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH N.Y.

TEUTHIS CŒRULEUS (BLOCH & SCHNEIDER). BLUE TANG; MEDICO.

ABOUT TWICE NATURAL SIZE.

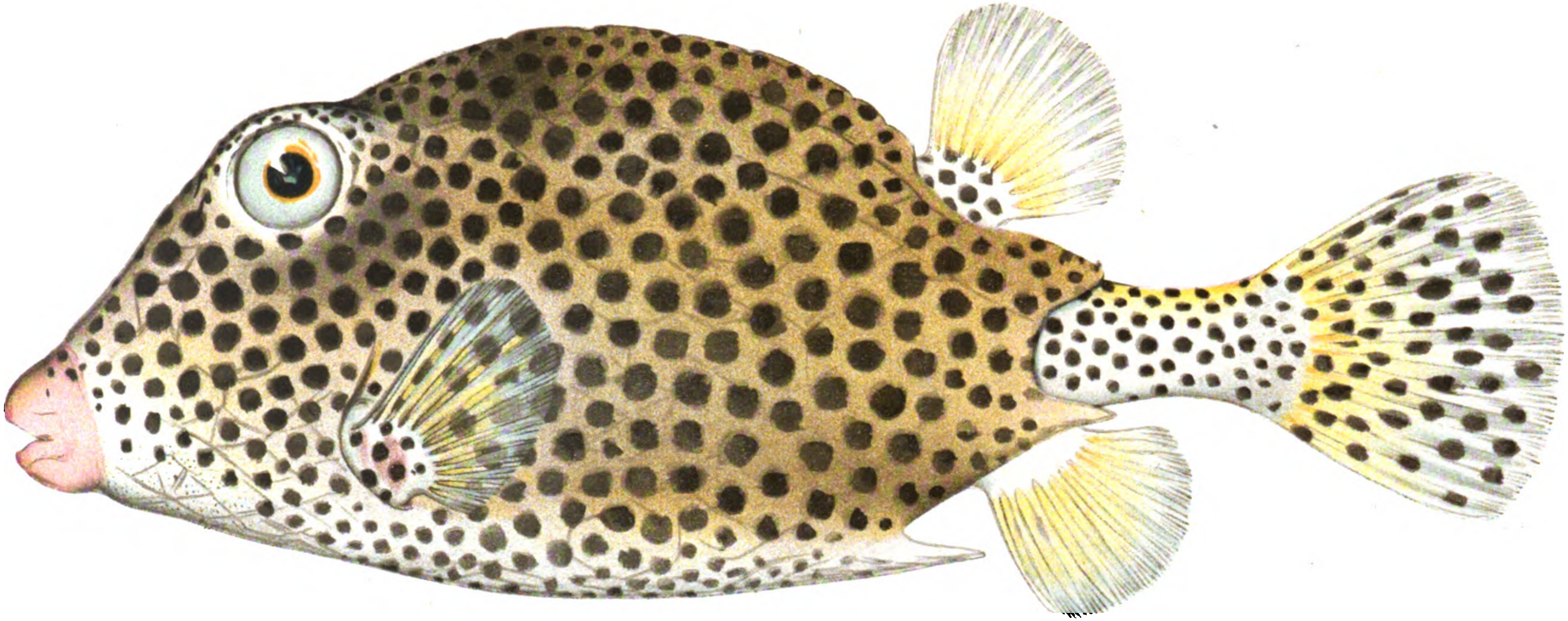
PLATE 39.



A. H. Baldwin ad nat. del.

BALISTES VETULA LINNÆUS.
ABOUT THREE-FOURTHS NATURAL SIZE.

JULIUS BIEN & CO. LITH. N.Y.



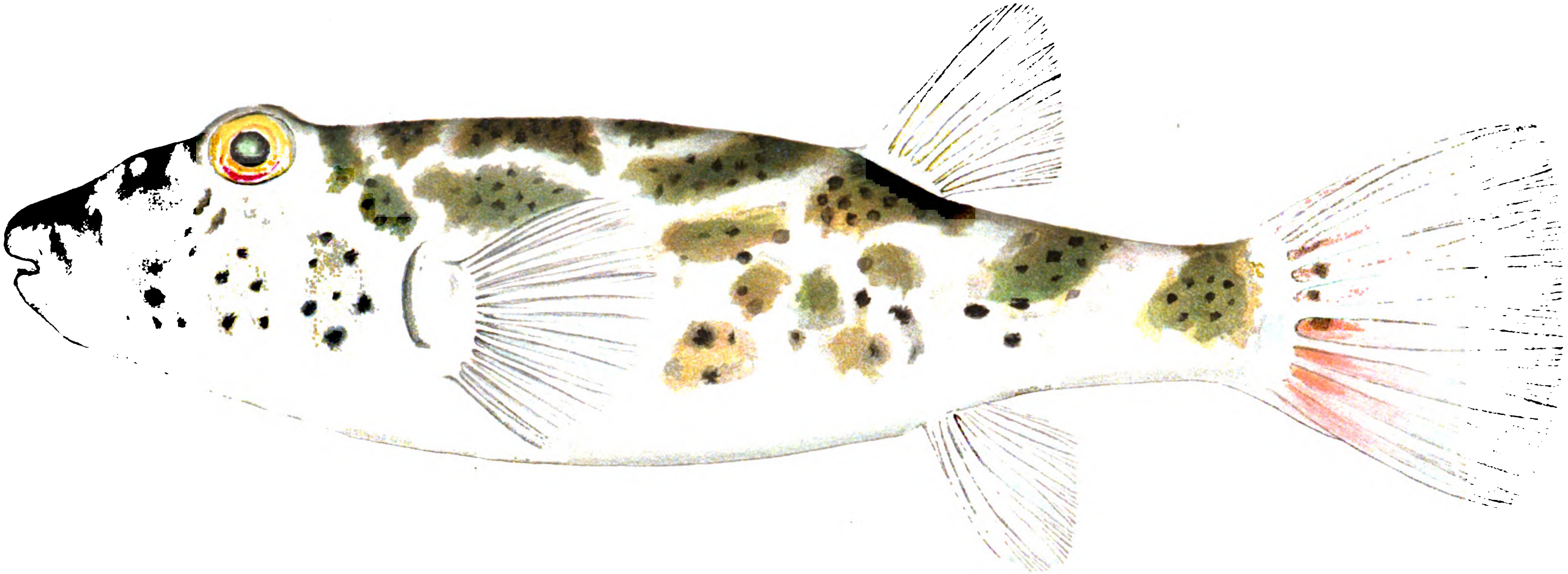
A.H Baldwin ad nat.del.

JULIUS BIEN & CO LITH N.Y.

LACTOPHRYS BICAUDALIS (LINNÆUS). SPOTTED TRUNK-FISH; CHAPIN.

NATURAL SIZE

PLATE 41.



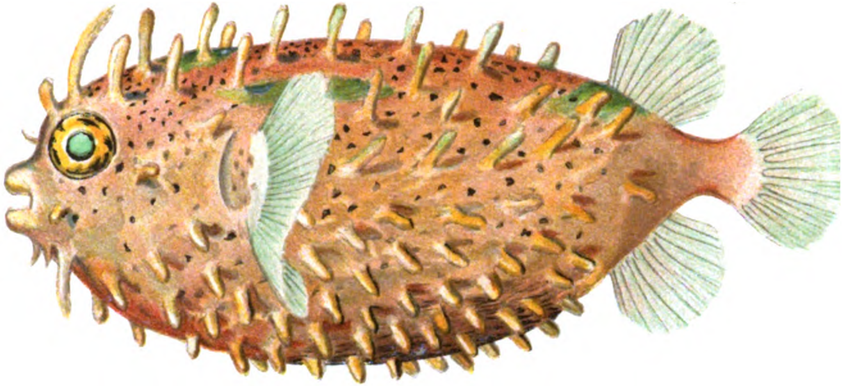
A. H. Baldwin ad nat. del.

SPHEROIDES TESTUDINEUS (LINNÆUS). PUFFER; TAMBORIL.

ABOUT 1⅐ TIMES NATURAL SIZE.

JULIUS BIEN & CO. LITH. N.Y.

PLATE 42.

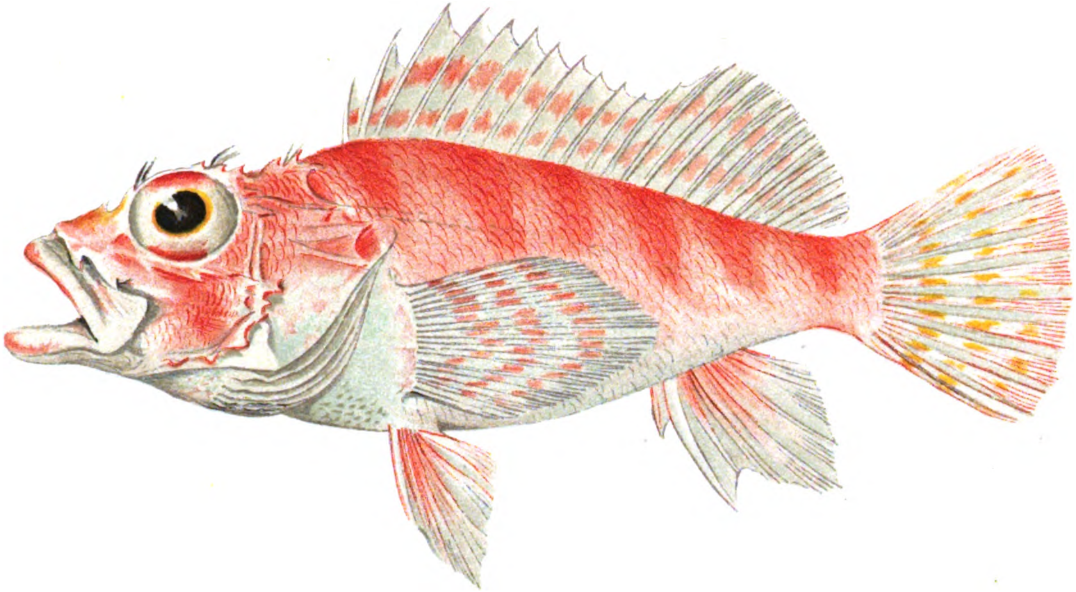


A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

CHILOMYCTERUS ANTENNATUS (CUVIER).

ABOUT 1½ TIMES NATURAL SIZE.

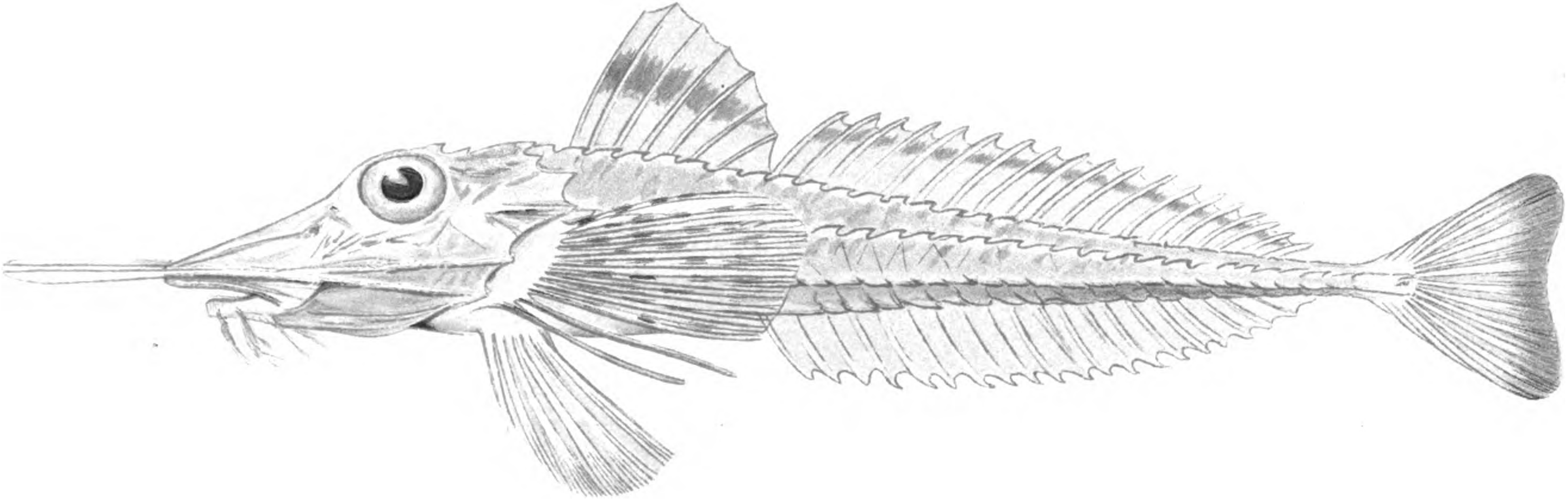


A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

PONTINUS MACROLEPIS GOODE & BEAN.
NATURAL SIZE.

PLATE 44.



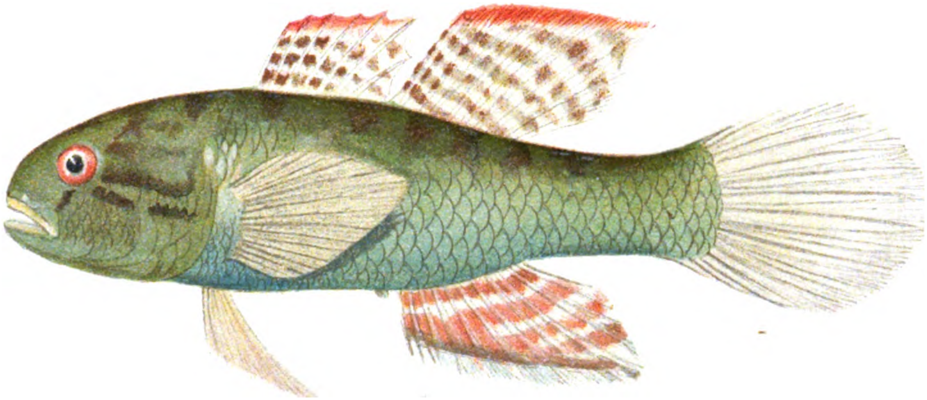
A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

PERISTEDION GRACILE GOODE & BEAN.

ABOUT 1 4/5 TIMES NATURAL SIZE.

PLATE 45.

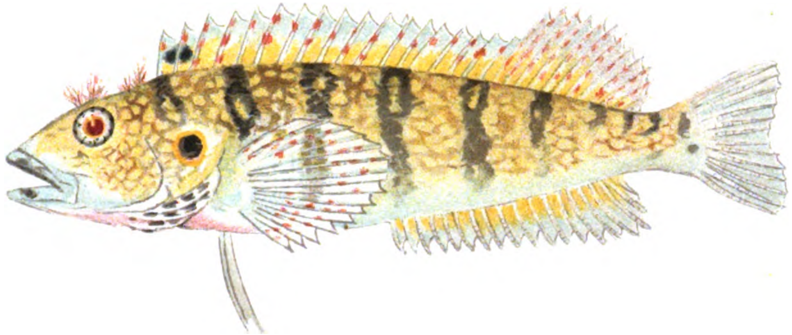


A.H Baldwin ad nat. del.

DORMITATOR MACULATUS (BLOCH).

NATURAL SIZE.

JULIUS BIEN & CO LITH N.Y.



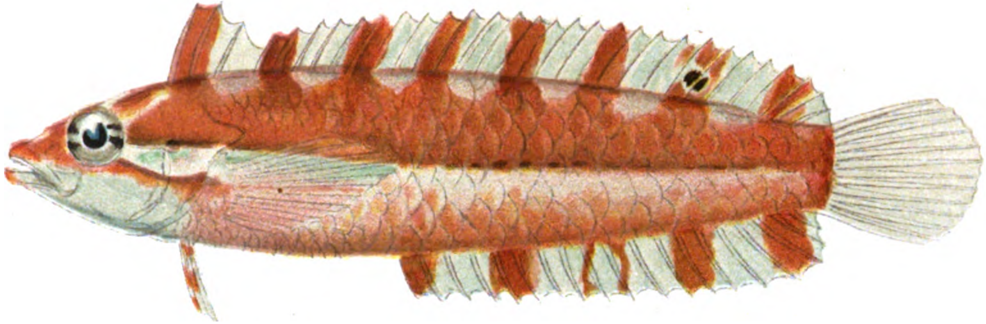
A. H. Baldwin ad nat. del.

LABRISOMUS NUCHIPINNIS (QUOY & GAIMARD).

NATURAL SIZE.

JULIUS BIEN & CO. LITH. N. Y.

PLATE 47.

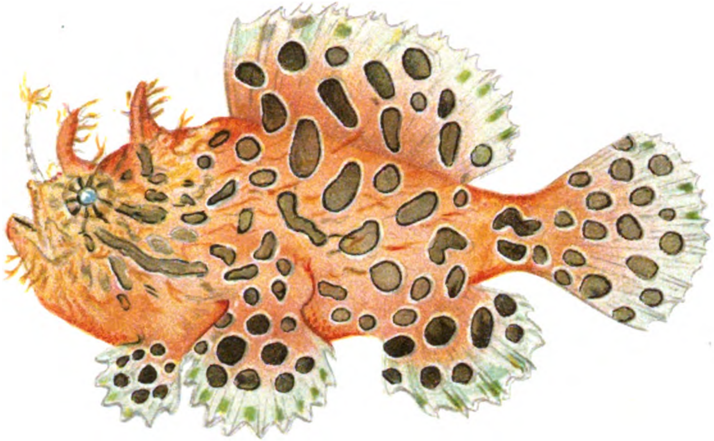


A. H. Baldwin ad nat. del.

JULIUS BIEN & CO LITH N Y

AUCHENOPTERUS FAJARDO EVERMANN & MARSH. TYPE.

NEARLY TWICE NATURAL SIZE.

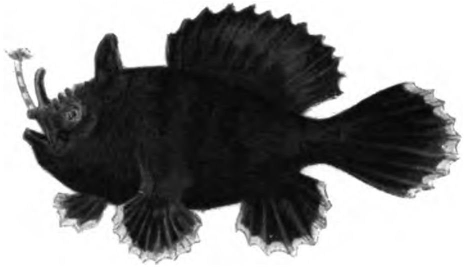


A.H. Baldwin ad nat.del.

ANTENNARIUS SCABER (CUVIER).
ABOUT 1 ⅓ TIMES NATURAL SIZE.

JULIUS BIEN & CO. LITH N.Y.

PLATE 49.



A. H. Baldwin ad nat. del.

JULIUS BIEN & CO. LITH. N.Y.

ANTENNARIUS NUTTINGII GARMAN. MURCIELAGO.

ABOUT 1½ TIMES NATURAL SIZE.

PLATE 48

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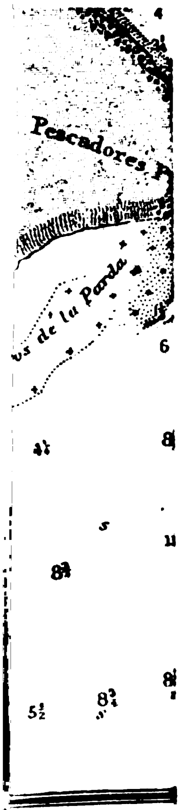

n, D.C.

THE MOLLUSCA OF PORTO RICO.

BY

WILLIAM HEALEY DALL

AND

CHARLES TORREY SIMPSON.

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THE MOLLUSCA OF PORTO RICO.

By W. H. DALL and C. T. SIMPSON.

INTRODUCTION.

The following report on the mollusks of Porto Rico is the result of a study of collections made by the U. S. Fish Commission steamer *Fish Hawk* during explorations of that island in 1899, and of the antecedent literature. But little attention seems to have been paid to the Porto Rican marine mollusk-fauna, considered separately from that of the West Indies in general, and only the land shells are at all well known. The principal sources of information are: (1) a paper by Shuttleworth on some land shells of the island;[1] (2) a monographic summary of the land and fresh-water shells, by Crosse;[2] (3) a similar summary of the whole mollusk-fauna, including the marine forms, by Gundlach;[3] (4) a brief paper on the land snails by von Martens.[4] The rest of the information is scattered through the literature of the West Indies and mollusks in general, from very early times. As with the West Indian fauna in most branches, apart from the birds and land shells, information as to the species is fragmentary and unsatisfactory, no equal area of the shores of countries equally long known anywhere else in the world being so imperfectly explored and with the recorded data in such great confusion. The sea-shell fauna of the West Indies was the source of a large proportion of the shells known to the earliest writers, and may be said to rank third in the order of importance in its contributions to the early iconographies, coming next after the European and Indo-Pacific regions. The localities were often stated erroneously or as unknown, and the same may be said of the great iconography of Reeve and Sowerby, based on the Cumingian collection. Many West Indian shells are there depicted with erroneous localities, and shells not known in the Antillean region are referred to it. The similarity of Spanish names in the Pacific, Oriental, and East American regions is no doubt partly responsible for this confusion. A few later lists, such as those of Beau and Fischer for Guadaloupe; Krebs and Mörch for the West Indies; Guppy for Trinidad; Poulsen for St. Thomas; d'Orbigny, in Sagra, and Arango, for Cuba, have done something toward clearing up the subject, yet it is still in a deplorably unsatisfactory state.

Some years ago the senior author of this report published an index to the periodical literature and fugitive papers on the malacology of this region,[5] in which references only, without any attempt at synonymy, were given for all citations of species supposed to be from the West Indies and adjacent shores. Considerable additions have since been made in the Blake Reports, the Proceedings of the United States National Museum, the Nautilus, and elsewhere. A supplement to the bulletin referred to, which should include the species cited from this region in the iconographies and the later issues of the periodicals mentioned, would be of immense service in helping to bring order out of the existing chaos.

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[1] Robert James Shuttleworth. Beiträge zur näheren Kenntniss der Land- und Süsswasser-Mollusken der Insel Porto Rico. Mitth. der Naturforschenden Gesellschaft in Bern, a. d. Jahre 1854. 8°. pp. 33–56, März 1854, and 89–103, Juni 1854.

[2] Joseph-Charles-Hippolyte Crosse. Fauna malacologique terrestre et fluviatile de l'île de Porto-Rico. Journ. de Conchyliologie, XI, pp. 6–71, 1892. Also issued separately in covers.

[3] Don Juan Gundlach. Apuntes para la fauna Puerto-Riqueña. Partes cuarto y quinta. Anales de la Soc. Esp. de Hist. Nat., XII, pp. 5–58 and 441–484, 1883. Also issued separately. 8°.

[4] Eduard von Martens. Land- und Süsswasser-Schnecken von Portorico. Jahrbuch der Deutschen malakologischen Gesellschaft, IV, pp. 340–367. 1877.

[5] Bulletin of the U. S. Geological Survey, No. 24. List of the marine mollusca from American localities between Cape Hatteras and Cape Roque, including the Bermudas. By William Healey Dall. Washington (the Survey), 1885. 336 pp. 8°.

Meanwhile all carefully determined lists of species from definite localities are of the utmost value, and only when a large number of these have been made can we expect to utilize the facts of inter-island or bathymetric distribution. The present report is intended to be of this character. Great care has been taken to identify the species correctly, while the question of ultimate nomenclature has in great part been left in abeyance. It is believed that the names assigned in every case belong to the species designated; but whether in all cases the designation used is the first which was ever applied to the species in question we have not attempted to determine, though in most cases it is believed to be so.

At the request of the authorities of the Commission, who hoped this report might be to some extent utilized as a handbook for the mollusks of the island, a brief description has been prepared by Mr. Simpson of the genera, subgenera, and species present in the collection. This has been a work of considerable magnitude and has occupied a great deal of time. The portion of this report relating to the land shells is entirely the work of Mr. Simpson, who has also had the task of compiling the list of species not represented in the Fish Commission collection. The work of the senior author has been chiefly devoted to the revision and verification of references, the confirmation of the identifications of the marine forms, the description of new marine species, and general editorial supervision.

Our intention has been to give a reference to the place where a species was originally described, and to a figure, without attempting elaborate synonymy. Several species hitherto unfigured, though described half a century ago, have now been figured from the author's types. Nearly all the new species are figured, and also a few forms not new or unfigured, but which are especially characteristic of this island, such as *Pleurodonte carocolla.*

It has been one of the surprises that a number of species originally described from deep water in the Blake Reports turned up in less than 100 fathoms in Mayaguez Harbor or other localities. It is evident that a thorough exploration with the mollusks especially in view, and systematically conducted dredgings, would add very materially to the list now presented.

In a discussion of the number of marine species normal to a fauna in a given zone of temperature[1] the conclusion was arrived at that, omitting strictly abyssal species, the average marine American tropical shell-fauna comprises about 581 species, and, as none of the faunas cited could be regarded as thoroughly known, it would doubtless be well within the mark to call it in a round number 600 species.

Porto Rico has a sufficient variety of coast, with rocks, flats, sheltered harbors, currents, and submarine declivities, to sustain a fully average representation of the marine fauna of the region of which it forms a part. The extraordinary richness of some spots, as in Mayaguez Harbor, where a few hauls of the dredge were taken, affords sufficient evidence that there is no unusual paucity of molluscan life about the island in proper situations. Hence we may reasonably expect the total census of shell-bearing mollusks, when carefully made, not to fall short of the average above indicated for such faunas. Excluding land and fresh-water shells, and nudibranchs, the total number of species and well-marked varieties included in the present report is 530. We may therefore suspect that about 70 marine species, actually existing somewhere about the island, remain to be collected and identified before our catalogue can be regarded as approximately complete.

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[1] Bulletin of the U. S. Geological Survey No. 84. Correlation Papers. Neocene, by William Healey Dall and Gilbert Dennison Harris. Washington (the Survey), 1892. 8°. pp. 349. See pp. 25–31.

The most interesting feature of what we may call the West Indian fauna as a whole is its extent beyond the limits which have been ordinarily assigned to it. Off the eastern coast of North America, outside of the narrow strip of colder water which makes its way close inshore nearly to the coast of Georgia, the West Indian fauna in the warm waters of the Gulf and equatorial currents extends northward over the vast area of the continental plateau and slope fully to the latitude of Cape Hatteras, as has been proved by the dredgings of the U. S. Fish Commission. On the south the species extend along the coast of Brazil to the estuary of the River La Plata, though in constantly diminishing numbers.

As on the Pacific shore the Panamic fauna stretches from Point Conception, Cal., south to the Bay of Guayaquil, so the companion fauna of the West Indies covers an even greater extent of coast, on which it may doubtless hereafter be divided into a certain number of subordinate faunulæ. The fact that the stretch of coast now sterilized by the fresh waters of the Amazonas has not acted as a barrier is tolerably good evidence that the existing distribution, in its main features, antedates the formation of this immense river system.

The number of new species among the marine forms collected by the U. S. Fish Commission and described in this report is 42. The total number of species accounted for in the present report may be tabulated as follows:

Cephalopoda	6	
Pteropoda	8	
Gastropoda:		
Tectibranchiata	21, of which	2 are new.
Nudibranchiata	1, of which	1 is new.
Pulmonata:		
Akteophila	5	
Ditremata	2	
Limnophila	14	
Geophila	76	
Orthodonta, marine	129, of which	15 are new.
Streptodonta, marine	115, of which	9 are new.
Tænioglossa:		
Extra marine	14	
Fluviatile	2	
Docoglossa	4	
Rhipidoglossa:		
Marine	42, of which	1 is new.
Terrestrial	10	
Amphineura	20, of which	1 is new.
Solenoconcha	13	
Pelecypoda	171, of which	13 are new.
Total	653, of which	42 are new.

Using the common colloquial designations, there are 16 fresh-water shells, 102 land gastropods, and of marine mollusks, including the *Auriculacea* and *Truncatellidæ*, 535 species identified in this report.

The absence of *Pulmonata petrophila* is noticeable, but they undoubtedly exist, and will hereafter be detected on the shores of Porto Rico. The number of Nudibranchs is probably large, but, as in many other regions, they have not been collected and are therefore unknown. To some extent the same is probably true of the Cephalopods and Tectibranchs, while the census of the land and fresh-water shells is probably nearly complete. In Gundlach's list 212 marine species were enumerated, to which the researches of the United States Fish Commission now add 323, considerably more than doubling the number reported from Porto Rico, but no additions are made to the land shells enumerated in Crosse's catalogue.

The West Indies and Bahamas form a great conchological region, which is richer in species of land snails than any other area of equal size on the globe. The entire archipelago is estimated to contain about 95,000 square miles, and within it there are known something like 2,000 species of land and fresh-water mollusks. Of these less than a hundred are fresh-water forms.

The island of Cuba, with an area of 41,655 square miles, has nearly 700 species of land and fresh-water mollusks; Haiti, with 28,249 square miles, and which is not at all thoroughly explored, has about 270 species; Jamaica, with some 4,207 square miles, has not less than 500 species, and Porto Rico, with an area of 3,550 square miles, contains about 130 species. This region has been divided into a number of subregions by Fischer as follows: (1) Bahamas; (2) Cuba and the Isle of Pines; (3) Jamaica; (4) Haiti and Navassa; (5) Porto Rico, Vieques, St. Croix, St. Thomas, St. Johns, Tortola, Anguilla, St. Martin, St. Bartholomew, and Sombrero; (6) Guadeloupe, Martinique, Dominica, St. Christopher, Antigua; (7) St. Vincent, St. Lucia, Barbados, Grenada, Trinidad; (8) Windward Islands, Curaçao, Buen Ayre.[1]

While each of the four great islands Cuba, Haiti, Porto Rico, and Jamaica, and the groups of smaller islands given above, forms to some extent a subfauna, there is evidently a close relation between the faunas of these four islands and their small island dependencies, as far south as the Anegada Channel, and of the Bahamas. The character of the mollusks found to the south of this channel, which carries through a depth of not less than 900 fathoms, is markedly different and more South American in its relations.[2]

The northern part of the Lesser Antillean Chain is of volcanic origin, and is probably much more recent than the Greater Antillean Islands. While a few stragglers may have passed from the northern islands to the southeastern ones, it is not unlikely that there has been no land connection across the Anegada Channel within the period of the existing West Indian land-mollusk fauna.

One of the remarkable features of this fauna is the large proportion of operculated land mollusks. There are within this area not less than 600 species of these, or 30 per cent of the entire fauna. In Cuba and Jamaica they form one-half of the land-snail fauna, but only about one-fourth of that of Porto Rico.

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[1] Manuel de Conchyliologie, p. 269. These divisions are founded in part on the studies of Bland.

[2] See Distribution and Classification of the Land and Fresh-water Mollusks of the West Indian Region, Proc. U. S. National Museum, XVII, pp. 424 and 443, 1894.

Another striking feature of the land-snail fauna of the region is the presence of large, generally dark-colored and solid snails of the genus *Pleurodonte.* They are all ground snails; they are usually abundant, and are probably found in all the subregions of the West Indies region. Another great and characteristic group, which, like *Pleurodonte*, has its metropolis in this region, is the old genus *Cylindrella*, but which is now divided into several genera forming the family *Urocoptidæ.*

The land-snail fauna of Porto Rico is not especially striking, though there are a few very fine large species of *Pleurodonte*, notably *P. carocolla*, *P. angulata*, *P. luquillensis*, and *P. marginella.* The latter, or a closely related form, is found also in the islands of Haiti and Cuba.

The solitary *Circinaria concolor*, if it be a genuine *Circinaria*, is a remarkable case of geographical distribution, all the other species being confined to the United States. Equally remarkable is the single *Clausilia bicanaliculata*, which is found only in Porto Rico, there being no other species of the genus known from the West Indian region. The genus has its metropolis in southeastern Europe, where both species and individuals are very abundant. It is represented by numerous species in Eastern Asia, by a few in the Malay Archipelago, the Madeira Islands, and along the west coast of South America.

There is a single species of *Stoastoma* found in Porto Rico, another comes from Haiti, and about 80 species are found in Jamaica. All the species are minute, the largest being less than 5 millimeters in diameter. *Pineria viequensis* comes from the island of Vieques, but has not, so far as we know, been reported from Porto Rico. Two other species belong to Cuba and the Isle of Pines, and another is found in the Lesser Antilles. The genus *Gæotis*, with four species, the animal being large, broad, and depressed, with a fragile sigaretiform shell, is confined to the island of Porto Rico. There are a number of species of *Helicina*, *Cistula*, *Choanopoma*, and *Chondropoma* in the island, but they have no remarkable characters. *Planorbis* and *Planorbula* are largely represented, there being no less than ten species of the two genera.

In his account of the land and fresh-water mollusk fauna of Haiti,[1] Crosse divides the island into four subregions, as follows: First, that of the Sierra de Monte Cristo on the north, extending from Monte Cristo on the west to the Bahia Escocesa on the east. South of this there is a wide subarid plain. Second, the region of the Sierra del Cibao, extending from the Mole St. Nicholas on the west to Cape Engano, the extreme eastern end of the island. There is a third subregion extending from Cape Dame Marie, the extreme southwest point of the island, eastward to beyond the center of it, and a fourth lying between the two western peninsulas. The subregion on the southwest peninsula has a land-snail fauna closely allied to that of Jamaica; that of the Sierra del Cibao, which reaches from the extreme northwestern point to the eastern end, has a fauna which is much like that of eastern Cuba, and also much like that of Porto Rico. It is in this region of the Sierra del Cibao that the large, dark Pleurodontes are found, which are closely related to forms of the same genus in eastern Cuba and to those of Porto Rico. In fact, *Pleurodonte marginella*, or very closely allied forms, are found in eastern Cuba, throughout the

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[1] Journ. de Conch., XXXIX, 1891, p. 195. See also the same, XL, 1892, p. 54.

Cibao region of Haiti and Porto Rico. *Cerion striatella*, *C. microstoma*, *Pseudobalea dominicensis*, *Guppya gundlachi*, *and Pupa pellucida* have a similar distribution, and the present distribution of these species would seem to be a hint at a period within their existence when there was a continuous land connection between the three islands.

The form of the catalogue needs no special explanation. It may be remarked that when there is no reference to any authority for the presence of a species in the Porto Rican fauna, it may be understood to have been collected by the United States Fish Commission.

For convenience of reference, a check list of the species included in the report follows the main body of the text, together with a list of the Fish Commission stations at which mollusks were collected.

We are under obligations to Mr. W. E. Hoyle, of the Owens College, Manchester, England, for examination of a species of *Octopus*, a group upon which he is regarded as an authority; also to Dr. Rudolph Bergh, of Copenhagen, Denmark, for the determination of a nudibranch.

U. S. NATIONAL MUSEUM, DIVISION OF MOLLUSKS,
January, 1901.

Class CEPHALOPODA.

Order DIBRANCHIATA.

Suborder OCTOPODA.

Family OCTOPODIDÆ.

Genus OCTOPUS Lamarck, 1799.

Animal with a rounded body; the eight long arms provided on their inner surfaces with two rows of suckers. The third right arm of the male is altered for sexual purposes. Type, *O. vulgaris* Lamarck.

Octopus americanus d'Orbigny.

Octopus vulgaris Lamarck, var. *americanus* d'Orbigny, in Sagra, Moll. Cubana, I, p. 14, pl. I, 1841.

One small specimen is in the Fish Commission collection, taken at Ensenada Honda, Culebra, but the arms are so badly mutilated that it can not be identified with certainty.

Octopus granulatus Lamarck.

Octopus granulatus Lam., Mém. Soc. Hist. Nat. Paris, I, p. 20, 1799.

Body slightly flattened, with a median ventral groove; mantle opening extending nearly half way round the body; head a little narrower than the body; eyes prominent; arms rather short, stout; the first three suckers in a nearly straight row; surface covered with small warts, violet brown; under a lens it is seen to be finely covered with dots. Our specimens are so contracted by the alcohol that measurements can not be given.

Porto Rico, no special locality, three fine specimens; San Juan Harbor, one specimen; Ensenada Honda, Culebra, several young specimens.

Octopus tehuelchus d'Orbigny.

Octopus tehuelchus d'Orbigny, Voy. Am. Mérid., p. 27, pl. I, figs. 6, 7, 1835.

Body slightly flattened and having a well-marked ventral groove, smooth; arms elongated, the upper pair shorter; umbrella extending one-fourth the length of the arms; siphon rather small. Color brownish, finely dotted. Entire length of largest specimen, 90 mm.

Ensenada Honda, Culebra, six specimens; Ponce, Porto Rico, one specimen.

The following form does not seem to agree with anything that has been described, and is perhaps new.

Octopus tuberculatus Blainville, junior?

? *Octopus tuberculatus* Blainville. Dict. Sci. Nat., XLIII, p. 187, 1826.

Body slightly flattened, with a well-marked median ventral groove; mantle opening extending about two-fifths of the way around the body; siphon rather long, nearly smooth, not attached along the base of the arms; head a little narrower than the body; eyes prominent; arms long, nearly equal in length; umbrella small, more developed at the sides than above; suckers small, prominent, radially ridged, first four in a slightly zigzag line; hectocotylized arm ending in a long, roughened spur; surface marked with somewhat scattered, small pustules and wrinkles, and having a few curious warty processes on the back of body and head; some of these are finger-like and two, situated close to the eyes and partly between them, are branched.

Color pale violet above, the whole surface sprinkled with minute dots; there are two eye-like circular dark spots, one on each lower side of the head, which appear to be permanent.

Length of body, 35 mm.; of arms, 60 mm.

St. Thomas, one specimen.

This small *Octopus* presented a very special appearance, owing to the two sharply defined dark spots on the head; and, suspecting that it might be new, it was submitted to Mr. W. E. Hoyle, of Manchester, England, an authority on these animals, for examination. He kindly reports that the specimen is young and may perhaps be the immature form of *O. tuberculatus* Blainville, but that it appears inadvisable to describe it as new in the absence of full-grown specimens.

O. tuberculatus has been recorded from the Antilles and, if found at St. Thomas, may probably also inhabit Porto Rico.

Suborder SEPIOPHORA.

Family LOLIGINIDÆ.

Genus LOLIGO Lamarck, 1799.

Loligo gahi d'Orbigny.

Loligo gahi d'Orbigny. Voy. Amér. Mérid., p. 60, pl. III, figs. 1, 2, 1835.

Four specimens of what are probably the above were taken in Mayaguez Harbor, Porto Rico, but they are not in condition to be described.

Family SPIRULIDÆ.

Genus SPIRULA Lamarck, 1801.

Spirula australis (Lamarck) Pelseneer. Plate 56, fig. 4.

Spirula australis Lam., An. sans. Vert, VII, p. 600, 1822: Encyc. Méth. pl. 465, fig. 5, *a*, *b*.

Several imperfect shells of the above were collected at Hucares, Porto Rico, and Ensenada Honda, Culebra. The species has an almost universal distribution in warm seas, and millions of shells are thrown up on the seashore. Few animals have ever been obtained, and these are for the most part in an imperfect condition.

There are several species of *Spirula* which can not be discriminated by the shells alone. In the paper by Huxley and Pelseneer on the *Spirula* of the *Challenger* voyage the name *australis* given by Lamarck is fixed on the Antillean species. Some additional data relating to this form are printed in Science, n. s., vol. III, No. 59, Feb. 14, 1896, pp. 243–245, from a specimen taken from the mouth of a fish trawled by the *Albatross* in the Gulf of Mexico, in 324 fathoms.

Class GASTROPODA.

Subclass ANISOPLEURA.

(EUTHYNEURA).

Order PTEROPODA.

Suborder THECOSOMATA.

Family CAVOLINIIDÆ.

Genus CLEODORA Péron & Lesueur, 1810.

Subgenus CRESEIS (Rang, 1828) Sowerby, 1833.

Shell elongate-conical, straight, with a slightly gyrate sulcus extending from the apex to the aperture where it is produced as a point projecting above the oblique margin of the aperture dorsally.

Type, *Creseis spinifera* Rang = *C. subula* Quoy & Gaimard.

Creseis subula Quoy & Gaimard. Plate 57, fig. 1.

Cleodora subula Quoy & Gaimard, Ann. Sci. Nat., x, p. 233, pl. viii, D, figs. 1-3, 1827.
Styliola subula Pelseneer, Challenger Pteropods, ii, p. 56, 1888.

The genus *Creseis* Rang was at first heterogeneous; one of the species was already the type of the genus *Vaginella* Daudin; the others comprised species of *Cadulus*, *Creseis*, and *Styliola*. In his Genera (pt. xxxix, Pteropoda, 1833), Sowerby figured *C. subula* as an example of the genus *Creseis*, and in his Manual (1839, and 2d ed., 1842) again cites it as a type and specifies among the characters of the genus the dorsal sulcus. Finally Gray (Fig. Moll. An., iv, p. 122, 1850) defined the genus in harmony with the preceding, and at the same time defined *Styliola* (as in the original diagnosis of Blainville) as including those species with a cylindrical section and simple circular aperture. It will therefore be seen that there is no good ground for the view taken by Fol and Pelseneer for referring the present species to *Styliola*. The sulcus is reflected by a ridge on the interior of the shell, and the cross section of the shell is "heart" shaped. As the original description of *Styliola* states that the cross section of that genus is circular, the type can not have been a specimen of this species.

The present species is abundant in West Indian waters, and four specimens were obtained at Mayaguez, Porto Rico, by the Fish Commission party.

Genus STYLIOLA (Lesueur, 1826) Gray, 1850.

Shell elongate-conical, straight or curved, with a smooth surface, circular section and aperture; the plane of the simple aperture is at right angles to the longitudinal axis and the margin is not oblique, angular, or sulcate.

Type, *Styliola recta* Lesueur.

Styliola acicula Rang.

Cleodora (*Creseis*) *acicula* Rang, Ann. des Sci. Nat., xiii, p. 318, pl. xvii, fig. 6, 1828.
Styliola recta (Lesueur, 1826) *fide* Gray, *op. cit.*, 1850.

Shell thin, aciculate, elongated, with a polished surface; often slightly curved or flexuous; with the apical termination slightly bulbous; transparent or whitish.

Length, 10; max. diam. (at the aperture), 0.75 mm.

Mayaguez, many dead specimens.

The specimens agree with others, from the collection of Rang, in the National Museum. The slenderness of the specimens is variable, some being relatively stouter than others.

Genus CUVIERINA Boas, 1886.

Shells straight, subtransparent, subcylindrical, the apex sharp in the young but falling off in the adult state; aperture simple, slightly compressed.

Cuvierina columnella Rang.

Cuvieria columnella Rang, Ann. Sci. Nat., XIII, p. 323, pl. XLV, figs. 1-8, 1828.

Adult shell somewhat vase-shaped; aperture compressed a little and subtriangular, slightly expanded at the sides, upper end of the shell decollated, convex, showing the scar of the elongated pointed spire. Color milky white.

Length 10; greatest diameter, 3 mm.

Mayaguez, Porto Rico, one dead specimen.

Genus CAVOLINA Abildgaard, 1791.

Shell inflated, subglobular, thin; ventral face swollen; dorsal face longer than the ventral, drawn out in front; aperture compressed and continued as a fissure around each side of the shell.

Section DIACRIA Gray, 1842.

Cavolina trispinosa Lesueur

Hyalæa trispinosa Lesueur, Blainville Dict. Sci. Nat., XXII, p. 82, 1821.
Hyalæa trispinosa Sowerby, Conch. Icon., XX, 1878, pl. III, fig. 15.

Shell compressed, with three strong, straight spines, one on each side at the posterior termination of the fissure, and a longer one behind, longitudinally ribbed on the ventral face; dorsal lip slightly recurved, ventral lip strongly recurved. Color whitish, nearly transparent, smoky tinted.

Length, 10; greatest width, 7 mm.

Off Aguadilla, one dead specimen.

Section CAVOLINA s. s.

Cavolina longirostris Lesueur.

Hyalæa longirostris Lesueur, Blainville Dict. Sci. Nat., XXII, p. 81, 1821.
Hyalæa longirostris Sowerby, Conch. Icon., XX, pl. II, fig. 12, 1878.

Upper face of shell nearly hemispherical, marked with delicate concentric ridges; dorsal face longitudinally ribbed, prolonged in front into a long, somewhat folded, depressed beak; lateral spines compressed, central spine short, truncated.

Length, 4 mm.

Mayaguez, Porto Rico, many dead shells.

Cavolina uncinata Rang.

Hyalæa uncinata Rang, d'Orbigny, Voy. Am. Mérid., V, p. 93, pl. V, figs. 11-15, 1836.

Shell much swollen ventrally, the surface delicately and regularly reticulated, with fine, concentric ridges in front; dorsal face with three low, radiating ribs, turned downward and nearly evenly rounded at the aperture; lateral spines compressed and curved slightly backward, central spine rather short, stout, and curved upward. Color pale amber.

Length, 9; breadth, 6 mm.

Mayaguez, six dead shells.

Cavolina inflexa Lesueur.

Hyalæa inflexa Lesueur. Nouv. Bull. Soc. Philom., III, p. 285, pl. 5, fig. 3, 1813.

Shell elongated, compressed; ventral face but slightly inflated; ventral lip rounded, scarcely produced in the center, marked off by a deep sulcus; dorsal face faintly three-ribbed; dorsal lip nearly plain, somewhat produced in the center; lateral spines small, turned backward a little; central spine long and stout, curved upward.

Length, 5 mm.

Mayaguez Harbor, one dead shell.

Cavolina gibbosa Rang.

Hyalæa gibbosa Rang in d'Orbigny, Voy. Am. Mér., V, p. 95, pl. V, figs. 16-20, 1836.

Shell moderately inflated, ventral face produced in front into a high, almost sharp ridge, which is strongly, concentrically striated, the rest of its surface finely reticulated, its lip but slightly produced; dorsal face convex, nearly smooth or having about seven faint, longitudinal ridges; upper lip moderate or somewhat produced, turned sharply downward; lateral spines very short, rather near together, central spine short, stout, slightly curved upward.

Length, 9; breadth, 5; breadth across lateral spines, 4 mm.

Mayaguez Harbor, one broken specimen.

This is the *Hyalæa flava* of d'Orbigny, 1836, and *H. gegenbauri* Pfeffer, 1880.

Order OPISTHOBRANCHIATA.

Suborder TECTIBRANCHIATA.

(Cephalaspidea).

Family ACTÆONIDÆ.

Genus ACTÆON Montfort, 1810.

Shell oval, spirally striate, with conical spire and channeled suture. Aperture long, narrow above, broadly rounded below; outer lip simple and acute; columella twisted into a strong spiral fold. Parietal wall without folds or teeth.

Type, *A. tornatilis* Linnæus.

Actæon punctostriatus C. B. Adams.

Tornatella punctostriata C. B. Adams, Boston Journ. Nat. Hist., III, p. 323, pl. III, fig. 9, 1840.

Shell small, elliptical; whorls about 4, the last showing revolving, punctate striæ on its basal half; the central part of the whorl is smooth, and there are sometimes a few subsutural lines; nucleus somewhat depressed, suture deep, bordered externally by revolving grooves, which show through on the inner side of the outer lip. There is a good deal of variation in the color, being sometimes variegated, nebulously banded, or white.

Length, 3 to 6 mm.

Mayaguez, Porto Rico, eight dead specimens.

Family RINGICULIDÆ.

Genus RINGICULA Deshayes, 1838.

Shell small, solid, nearly white, ovate globose with conical spire; aperture conspicuously notched and channeled at base; outer lip thickened, often dentate within, callous outside; columellar margin callous, with two to four strong entering folds.

Type, *R. ringens* Lamarck.

Ringicula semistriata d'Orbigny. Plate 57, fig. 11.

Ringicula semistriata d'Orbigny, Moll. Cubana, II, p. 103, pl. XXI, figs. 17-19, 1845.

Shell ovate-conic, solid, whitish, smooth above and having revolving striæ below; suture impressed, columella strongly biplicate, and there is a callous tooth on the parietal wall; outer lip greatly thickened, subtuberculate in the middle.

Height, 2; diameter, 1 mm.

Mayaguez, Porto Rico, two dead shells.

Family TORNATINIDÆ.

Genus TORNATINA A. Adams, 1850.

Shell cylindrical, with a conic or flattened spire, the apex projecting and mammillar, sinistral, tilted so that its axis lies at an angle of about 90 degrees with that of the shell. Suture channeled; aperture long, narrow above, dilated and rounded below; outer lip arched forward, retreating at the suture and base, columella with one spiral fold at its junction with the whorl.

Type, *T. voluta* Quoy & Gaimard.

Tornatina bullata Kiener. Plate 57, fig. 9.

Tornatella bullata Kiener, Sp. et Icon. Coq. Viv., p. 5, pl. I, fig. 4.

Shell cylindrical, rather solid, white; suture deeply channeled; body whorl having very minute, wavy, revolving sculpture; aperture long and narrow; outer lip advanced in the middle; columellar plication rather strong.

Length, 7; diameter, 3 mm.

Mayaguez, Porto Rico, one shell; Vieques, a single badly worn specimen. Both seem to be fully adult, but are probably a small variety. The revolving sculpture is distinct on the best preserved specimen.

Tornatina candei d'Orbigny. Plate 57, fig. 7.

Bulla candei d'Orbigny, Moll. Cubana, I, p. 128, pl. IV *bis*, figs. 1-4, 1842.

Shell small, subcylindrical, widest at the shoulder; spire low conical; surface smooth except for faint growth lines, shining, milky white. Outer lip advanced in the middle; columellar fold moderate.

Length, 2.5; diameter, 1.5 mm.

Mayaguez, Porto Rico, five worn specimens.

Genus VOLVULA A. Adams, 1850.

Shell subcylindrical or long oval, tapering at both ends, body whorl produced into a beak or spine above. Spire concealed; aperture as long as shell, narrow, produced above, columella with a slight fold.

Type, *V. acuminata* Bruguière.

Volvula oxytata Bush. Plate 57, fig. 8.

Volvula oxytata Bush, Trans. Conn. Acad. Sci., VI, p. 468, pl. LV, fig. 12, 1885.

Shell thin, cylindrical, with a sharp, spike-like apex and a tapering, rounded anterior end, shining, with four or five very fine, revolving, punctured lines at each end, and exceedingly faint microscopic striæ on intervening surface. Inner lip slightly reflected anteriorly over an umbilical chink.

Length, 2.5; diameter, 1 mm.

Mayaguez, Porto Rico, three shells.

Volvula acuta d'Orbigny.

Bulla acuta d'Orbigny, Moll. Cubana, I, p. 126, pl. IV, figs. 17-20, 1842.

Shell obovate, being widest near the spire, attenuated above and below, thin, white, with revolving striæ at the base, not perforated; columella scarcely flexuous.

Length, 2.5; diameter, 1 mm.

Mayaguez, Porto Rico, three worn shells.

Genus RETUSA Brown, 1827.

Shell small subcylindrical, with raised flat or sunken spire; aperture as long or nearly as long as the shell, narrow above, dilated below. Columella with or without a small fold.

Retusa cælata Bush.

Cylichna cælata Bush, Trans. Conn. Acad. Sci., VI, p. 468, pl. XLV, fig. 15, 1885.

Shell small, somewhat conical, truncated above; spire concealed in a deep pervious pit, within which one or two whorls are seen; the upper end of the shell is sculptured with beautiful, flexuous ribs which fade out a short distance down the body whorl; the basal part of the shell is rounded and sculptured with a few revolving, punctate lines; aperture narrow, suddenly becoming wider below, slightly drawn out at the base; columella faintly truncate below, with a minute chink behind it.

Length, 3; diameter, 1.5 mm.

Mayaguez, Porto Rico, two slightly worn specimens.

Family BULLIDÆ.

Genus BULLA Linnæus, 1758.

Shell elliptical or ovate, compactly involute, generally solid and with a mottled color pattern; spire sunken, umbilicated. Aperture as long as shell, rising above vertex, narrow above, expanded below; lip simple, columella short and concave. Type, *B. ampulla* Linnæus.

Bulla amygdala Dillwyn.

Bulla amygdalus Dillwyn, Descr. Cat. Rec. Sh., I, p. 480, 1817.
Bulla amygdala Pilsbry, Man. XV, p. 329, pl. XXXVIII, figs. 49, 50, 62-65, 1893.

Shell oblong, narrower toward the vertex, solid, rather dull, clouded and mottled with purplish on a pale ground. Surface generally without microscopic revolving striæ, but having a few spaced lines at the base, and rarely a few at the vertex; umbilicus deep, striated within. Outer lip thick, callous where it rises from the vertex, its outer part straight. Columella arcuate, with a very heavy reflected callus, which has a chink behind it.

Length, 40; diameter, 23 mm.

Arroyo; San Geronimo; Boqueron Bay; Aguadilla; Guanica; Porto Real; Ponce, Porto Rico.

The distinctions between this form and *B. striata* Brug. of the Mediterranean region are faint and somewhat inconstant. As a rule, *amygdala* is more inflated and has a smaller umbilicus at the vertex than *striata*, but this is not always the case. The *striata* is more apt to have revolving lines at the vertex and microscopic spiral lines on the body than *amygdala*, but specimens of the former occasionally exhibit these characters.

Family AKERATIDÆ.

Genus HAMINEA Leach, 1847.

Shell thin, fragile, unicolored, yellowish or greenish, globose, ovate or subcylindric; vertex concave, imperforate or minutely perforate; aperture as long as the shell, narrow above, wider below; umella concave, thin, showing a slight fold where it joins the body of the shell.

Type, *Bulla hydatis* Linnæus

Haminea elegans Gray.

Bulla elegans Gray, Ann. of Philos., new ser., IX, p. 408, 1825.
Bulla guildingi Swainson, Mal., pp. 251, 360, fig. 46, 1840.

Shell roundly oval or subcylindrical; surface with irregular growth lines, and showing plainly close, spiral striation, which is usually straight but sometimes a little wavy; vertex concave, narrowly and deeply perforated, the outer lip rising from the left side of the perforation; outer lip well arched, rounded above and below; columella deeply arcuate; parietal callus thin, encircling the perforation at the vertex. Color brownish or greenish yellow, lighter above and below.

Length, 19; diameter, 13 mm.

One broken specimen in fresh condition was taken at Mayaguez Harbor, Porto Rico.

Haminea succinea Conrad.

Bulla succinea Conrad, Proc. Acad. Nat. Sci. Phila., III, p. 26, pl. 1, fig. 5, 1846.

Shell thin, horny, cylindrical, somewhat wider at the base; vertex truncated, narrowly, deeply impressed, minutely perforated, the lip inserted on right side of perforation; surface densely, evenly, spirally striated throughout, striæ slightly wavy; aperture long, narrow and parallel sided above, wider below; columella very concave, folded above, the lip reflexed and appressed to the umbilical region.

Length, 10; diameter, 6 mm.

A single broken specimen was collected at Culebra Island, which seems to be this.

Family HYDATINIDÆ.

Genus HYDATINA Schumacher, 1817.

Hydatina physis Linnæus.

Bulla physis Linnæus, Syst. Nat., ed. X, p. 727, 1758.
Hydatina physis Pilsbry, Man., XV, p. 387, pl. XLV, figs. 14–17, 1893.

Porto Rico (Gundlach); West Indies; west Africa; central Pacific; Indian Ocean, etc.

Genus MICROMELO Pilsbry, 1894.

Micromelo undata Bruguière.

Bulla undata Bruguière, Enc. Meth., I, p. 380, 1791.
Micromelo undata Pilsbry, Man., XV, p. 392, pl. LIX, figs. 20–24, 1893.

Porto Rico (Gundlach); West Indies; Honduras (Simpson).

Family SCAPHANDRIDÆ.

Genus ATYS Montfort, 1810.

Shell solid, involute, oval, usually with spiral striæ at both ends; aperture projecting beyond the vertex and base; columella plicate or concave, generally somewhat reflexed over the small umbilicus.

Type, *A. cymbulus* Montfort.

Subgenus ATYS s. s.

Atys guildinii Sowerby.

Atys guildinii Sowerby, Conch. Icon., XVII, pl. V, fig. 26, 1869.

Shell inflated, thin, dull grayish white, attenuated into a rounded ridge above, where it is perforated or closed, umbilicated below; wrinkled with growth lines and spirally striate, especially at ends, where it is sometimes reticulated; outer lip decidedly elevated above; columella thin, slightly folded.

Length, 8; diameter, 5 mm.

Mayaguez Harbor, Porto Rico, one specimen; Ensenada Honda, Culebra, one shell.

Atys sandersoni Dall.

Atys? sandersoni Dall, Bull. Mus. Comp. Zool., IX, p. 99, 1881; Blake Rep., II, p. 54, pl. XVII, fig. 7, 1889.

Shell thin, polished, translucent white, with the aperture longer than the axis of the shell; growth lines faint; spiral sculpture consisting of about a dozen lines at each end of the shell, becoming faint or obsolete at center; vertex having a deep pit, from the center of which the margin of outer lip arises; columella nearly straight, reflected over the umbilicus and closing it, or only leaving a chink.

Length, 4; diameter, 2 mm.

Two young specimens were obtained in Mayaguez Harbor, Porto Rico.

(Anaspidea.)

Tectibranchs without a fleshy head shield.

Family APLYSIIDÆ.

Animal not protected by a shell, the neck and head narrower than the body; mouth a vertical fissure; two tentacular folded lobes above the head; two elevated rhinophores behind these, in front of which are the small eyes. Pleuropodia curved over the back forming two lobes inclosing mantle and gill. Genital orifice within the dorsal slit; shell nearly or quite covered by the mantle, a mere concave plate.

Subfamily APLYSINÆ.

Genus TETHYS Linnæus, 1758.

Pleuropodia arising in front of the middle of the animal's length, free, used as swimming lobes, mantle nearly covering the gill, having a median tube or orifice produced behind in a lobe or lobes forming an excurrent siphon; foot well developed; shell thin, with pointed, small apex, and having a concave posterior sinus.

It is better known under the generic name of *Aplysia*.

Tethys protea Rang.

Aplysia protea Rang, Hist. Nat. Apl., p. 56, pl. X, figs. 1-3, 1828.

Back much swollen; swimming lobes large; neck slender; tail pointed; foot large; surface generally covered with scattered, ring-shaped, dark markings.

Length, from 4 to 16 cm.

Ensenada Honda, Culebra Island.; Ponce Reefs; San Antonio Bridge, San Juan; Mayaguez; reefs at Guanica, Porto Rico; Caballo Blanco Reef, Vieques.

This form varies greatly in color, and among our numerous specimens as to size, some of which are probably young. In certain specimens the rings of color are heavy and distinct; in others there is scarcely a tint of the dark rings and there is every variation between. The inner sides of the pleuropodia and the mantle are variously marked with dark patterns of color.

Tethys cervina, n. sp. Plate 56, fig. 2.

Body elongated, flabby; mouth encircled by thick lips; tentacles short; eyes inserted in front of the tentacles. Swimming lobes thick, united behind at some distance in front of the hinder extremity; mantle orifice minute; mantle ending behind in a small fold; foot narrow, nearly smooth.

Colors: The body is a lurid gray overlaid with reticulations and blotches of darker color. It also has scattered, small, nearly round, smoky brown spots throughout its surface. The foot is smoky brown, lighter colored than the spots. The inner edges of the swimming lobes are beautifully and distinctly maculate, with alternating light and dark patches. The mantle is colored like the body, but the dark spots are wanting, and the dark reticulations are somewhat radiating. Length, 7 cm.

Shell with a rather strong layer of lime, elliptical in outline; posterior sinus moderate. Length of shell, 30; breadth, 19 mm.

Mayaguez, Porto Rico.

Nine specimens in alcohol were obtained by the expedition, all probably young. The pattern of coloring is quite constant in all, though in some specimens there are but few of the dark, smoky, round spots. As the description is from alcoholic material only, it is impossible to tell what the colors may be in a living state. Most of the specimens are badly shrunken or drawn up by the alcohol.

Tethys parvula (Guilding) Mörch. Plate 53, fig. 14.

Aplysia parvula (Guilding MS.) Mörch, Journ. de Conch., 1863, p. 22.
Tethys parvula Pilsbry, Man., XVI, p. 83, pl. XXXVII, figs. 23–25, 1895.

Body higher than wide; mouth placed well forward, with slightly wrinkled, thickened lips; rhinophores large, folded; tentacles rather small; eyes not seen; foot elongated, extending to a point behind, its border crimped; swimming lobes wide and almost auricled in front, narrower and united behind, closely inclosing the very large shell; mantle having a large oval opening which exhibits the shell. Excurrent siphon lateral, opening at posterior sinus of shell. Color, a dirty greenish white; border of foot, pleuropodia, and mantle opening intense black, as are the tips of the rhinophores.

Length of animal, 20; diameter of mantle opening, 5; length of opening, 6 mm.

Shell very large, solid, concave, covered with a rather thick epidermis, which peels on exposure to air; posterior sinus moderate, overhung by the epidermis; apex much incurved, callous, but having no recurved process. Interior calcareous, slightly iridescent, pinkish white, externally straw colored.

Length, 13; breadth, 9; height, 5 mm. Length of sinus, 5 mm.

Caballo Blanco Reef, Vieques, one specimen.

This specimen is badly contracted by the alcohol, and is not in good condition to study. The species is remarkable for the great size and solidity of its shell, which is deeply concave and covers the whole animal.

Subfamily DOLABRIFERINÆ.

Genus DOLABRIFERA Gray, 1847.

Animal ovate-oblong or sack-like, tapering toward the head. Eyes as in *Tethys*. Pleuropodial lobes located behind the middle of the body, scarcely mobile, inclosing a large gill cavity. Mantle small; foot broad. Shell small, nonspiral, solid, and calcareous.

Type, *D. dolabrifera* Cuvier.

? **Dolabrifera ascifera** Rang. Plate 56, fig. 8.

Aplysia (*Dolabella*) *ascifera* Rang, Hist. Nat. Aplys., p. 51, pl. IV, figs. 7–9, 1828.

Body (in alcoholic specimens) elongate ovate, swollen behind, more or less covered with warts; foot very large, of the same dimensions as the body and bordered by an expanded, wavy edge; rhinophores and tentacles small, shrunken; eyes minute, between the rhinophores and tentacles, a little nearer to the latter; dorsal slit in the posterior third of the body, to the right of the middle, about one-fourth the length of the body, buttonhole-like at its two ends. Right pleuropodial lobe overlapping the left, both lobes small. Length, 50 mm.

Shell somewhat narrowed, the apex much callous with strong growth lines outside, dead white, within callous and shining, quite solid. Length, 14; breadth, 7 mm.

Reefs, Guanica; Ponce, Puerto Rico; Ensenada Honda, Culebra; Caballo Blanco Reef, Vieques.

All our numerous specimens, some of which are no doubt young, are contracted by the alcohol and are much shorter than the length given by Pilsbry in the monograph of the *Aplysiidæ*. The shells, however, are longer than the measurement given by him, but have the general form of those figured by him for *D. ascifera*, though they vary considerably, some of them in the direction of *D. swiftii* Pilsbry. They are all solid and milky white outside.

? **Dolabrifera sowerbyi** Guilding.

Dolabrifera sowerbyi Guilding, Conch. Icon., XVI, pl. I, fig. 2, 1868.

Body in alcohol elongated, pear shaped, much swollen behind; foot wide, having a narrow, sharp border at its junction with body; head small; rhinophores and tentacles short, shrunken and wrinkled;

eyes about midway between them; mouth and lips small; dorsal furrow distinct in front, closed near dorsal slit, which is about one-third the length of the animal, situated behind the middle of the body, and not lateral; anus projecting as a large tube at the posterior end of slit; pleuropodia scarcely developed, of equal size, the right not projecting over the left. Surface pale lurid brown, covered with small mammillæ and faint sharp pustules. Length, 50; diameter, 25; height, 18 mm.

Shell elongated, solid, narrow at and behind the apex, somewhat contorted, a concave depression running down the back, whitish and dull without, polished within. Length, 13; breadth, 5 mm.

Hucares, Porto Rico, one specimen.

Only the shell of *D. sowerbyi* has been described, and nothing is known of the soft parts of the species. The shell of this specimen agrees pretty well with Sowerby's figures.

Genus NOTARCHUS Cuvier, 1817.

Ovate or fusiform, swollen in the middle. Pleuropodia united behind over a large gill cavity; dorsal slit subcentral, short. Foot narrower than the body, acute behind. Shell minute or wanting.

Type *N. indicus* Schweigger.

Notarchus pleii Rang.

Aplysia pleii Rang, Hist. Nat. Aplys., p. 70, pl. XXI, 1828.

Body long ovate, very soft and flabby. Branchial cavity large, a little in front of the middle of the body; foot long, projecting behind, moderately wide. Surface more or less covered with filaments and variously lobed, ragged processes.

Length of animal, 10 to 12 cm.; of branchial cavity, 35 mm.

Boqueron Bay, Porto Rico, many specimens.

Specimens in alcohol are most disagreeable, shapeless, flabby objects, of a dirty, bottle green. There is quite a little variation in the development of the filaments and processes on the body, some specimens being nearly covered with them and in others they are almost wanting.

(Notaspidea.)

Tectibranchs having the dorsal surface protected by a large shield.

Family PLEUROBRANCHIDÆ.

Gill plume arising about the middle of the right side and extending backward; dorsal shield fleshy; animal shell-less or having a small Haliotiform shell.

Genus PLEUROBRANCHUS Cuvier, 1804.

Body oval; mantle about the size of the foot, free and projecting at the edges all around; rhinophores contiguous, inserted below the mantle. Gill bipinnate. Shell auriculate.

Type, *P. peronii* Cuvier.

Pleurobranchus lacteus, n. sp. Plate 56, fig. 6.

Body elliptical; mantle soft, inflated, faintly pustulous and wrinkled, semitransparent; foot smaller than the mantle, emarginate in front, having a wrinkled undulate border; rhinophores elongated, compressed, drooping and suddenly curved upward near the ends, extending in front of the veil and mouth; veil truncated in front, with a small projecting lobe at each corner; mouth round, with thick lips, extending as far forward as the veil; male and female orifices at the summit of a double mammilla situated just at the front of the gill plume; gill plume attached about midway back on the body, attached the front three-fifths of its length, and having about 20 pairs of plumelets; anus just above the hinder point of attachment of the gill. Length, 22; breadth, 15 mm.

Shell oblong, depressed, thin but solid, having about 2 whorls; spire full, mammillary; suture well marked and ending in an emargination behind; growth lines developed into well-marked irregular ridges; surface covered with a thin, iridescent, whitish, or straw-colored epidermis. Length of shell, 5.5; breadth, 3 mm.

Animal and shell milky white.

Ensenada Honda, Culebra, five specimens.

This species does not at all agree with any of the three forms described by Mörch from the West Indies, and is probably new.

Order NUDIBRANCHIATA.

DORIDIDÆ CRYPTOBRANCHIATÆ.

Genus GEITODORIS Bergh, 1892.

Geitodoris mollina Bergh MS.

A single specimen of an undetermined nudibranch was obtained at Ensenada Honda, Culebra. A line from Dr. R. Bergh, to whom it was submitted, denominates it as above, but the description had not come to hand at date of printing.

Order PULMONATA.

Suborder BASOMMATOPHORA.

Superfamily AKTEOPHILA.

Family AURICULIDÆ.

Shell spiral, with reversed nucleus, covered with an epidermis, solid; spire more or less elevated; whorls flattened; aperture elongated, contracted by columellar teeth, often having teeth within the outer lip; columella generally twisted.

Genus MELAMPUS Montfort, 1810.

Shell oval conoidal; aperture elongated, narrow; columellar lip with several dentiform plications; columella plicate; outer lip sharp, with revolving ridges within; foot truncated in front, bifid behind.

Type *Melampus coniformis* Bruguière = *Voluta coffea* Linn.

Subgenus MELAMPUS s. s.

Melampus coffeus Linnæus. Plate 53, fig. 13.

Bulla coffea Linnæus, Syst. Nat., ed. x, p. 729, 1758.
Melampus coffea Binney, Bost. Journ. Nat. Hist., VII, p. 162, pl. LXXV, fig. 21, 25.

Shell conoidal, with a tolerably well-defined shoulder on last whorl above, which is ornamented with a narrow light-colored band; below this are generally two narrow, revolving, light bands, the general surface being lead color or lurid brownish; umbilical region sometimes rimate, at others entirely closed; on the columella is a single revolving lamina, and higher up on the parietal wall a double one; inner edge of outer lip brownish; within this are numerous elongated white teeth or liræ.

Length, 18; diameter, 12 mm.

San Juan; Catona, Porto Rico. Widely distributed in the West Indies, Florida, etc.

The light-colored revolving bands are sometimes very faint and occasionally are absent. The double parietal tooth is a tolerably constant character.

Melampus flavus (Gmelin?) Binney. Plate 54, fig. 9.

? *Voluta flava* Gmelin, Syst. Nat., p. 3436, 1792.
Melampus flavus Binney, Bost. Journ. Nat. Hist., VII, p. 166, fig., p. 167, 1863.
? *Melampus gundlachi* Pilsbry, Trans. Conn. Acad., x, p. 504, 1900.

Shell conoidal, brownish to chestnut, unicolored, or with two, sometimes three, revolving, light bands, the upper on the well-marked shoulder; the base of the shell is sometimes white; there is a single revolving subvertical lamina on the columella, and generally another on the parietal wall; the liræ inside the outer lip are white and irregular.

Length, 14; diameter, 9 mm.

San Juan; Ensenada Honda, Culebra Island; also West Indies; Florida, etc.

This and the preceding species vary much in form, color, and other characters, and there are specimens which can only be named with difficulty. Generally the *M. flavus* has a single lamina on the parietal wall, while that of *coffeus* is double, but this character is not absolutely constant. The former has generally irregular liræ inside the outer lip. Occasionally *M. coffeus* has a white base. The nearly vertical columellar fold is tolerably constant and characteristic.

Genus TRALIA Gray, 1840.

Shell elongated, with a plait on the columella and two on the body whorl; outer lip thickened, not lirate; foot entire, elongated, simple behind.

Subgenus TRALIA s. s.

Tralia pusilla Gmelin. Plate 54, fig. 13.

Voluta pusilla Gmelin, Syst. Nat., p. 3436, 1792.
Tralia pusilla Dall, Proc. U. S. Nat. Mus. 1885, p. 276, pl. XVIII, fig. 5.

Shell a rich, deep chestnut color, varying from oval to somewhat elongate, with a single fold on the columella and two on the parietal wall; outer lip thickened, inflected in the middle, where there is a single revolving ridge on its inner side.

Length, 13; diameter, 6.5 mm.

Ensenada Honda, many specimens.

Genus PEDIPES Scopoli, 1777.

Shell imperforate, oval to subglobular, with somewhat rounded spirally lirate whorls; columella rather wide and bearing two lamellar teeth; parietal wall with a third elevated, compressed, revolving tooth or lamella; outer lip somewhat callous within, generally thickened, often toothed. Foot short, rounded before and behind, divided below by a deep sulcus.

Pedipes mirabilis Mühlfeld. Plate 53, fig. 8.

Turbo mirabilis Mühlfeld, Mag. Ges. Nat. Freunde, Berlin, VIII, p. 8, pl. II, fig. 13, *a*, *b*, 1818.
Pedipes mirabilis Pfr., Mon. Auric., p. 70.

Shell small, globular-conic, with about four rounded whorls, which are occasionally slightly shouldered; whorls closely, spirally lirate; outer lip sometimes callous and having a low entering tooth within, sometimes not at all thickened or toothed.

Length, 3; diameter, 2 mm.

Ensenada Honda, Culebra. Many specimens taken alive.

This species appears to vary in size and in the character of the outer lip, and no doubt includes a number of nominal species described from the West Indies and Florida. Specimens in the National Museum collection, labeled "Indo Pacific," are considerably larger than the above, but agree in other characteristics.

Genus BLAUNERIA Shuttleworth, 1854.

Blauneria heteroclita Montagu.

Voluta heteroclita Montagu, Test. Brit., Suppl., p. 469, 1808.
Blauneria heteroclita Dall, Proc. U. S. Nat. Mus. 1885, p. 287, pl. XVII, fig. 6.

Shell slender, very minute, smooth, translucent, sinistral, with a single strongly marked fold.

Length, 3 mm.

Porto Rico; Arango; Cuba; Jamaica; Florida.

Superfamily LIMNOPHILA.

Family LIMNÆIDÆ.

Shell variable, spiral, elevated or discoidal; color uniform. Jaw simple, composed of three segments; teeth of the radula in horizontal ranges; marginal teeth serrate.

Subfamily LIMNÆINÆ.

Genus LIMNÆA Lamarck, 1801.

Limnæa cubensis Pfeiffer.

Limnæa cubensis Pfeiffer, Weigm. Arch., I, 1839, p. 354.

Porto Rico, several localities (Crosse); Santo Domingo; Cuba.

Subfamily PLANORBINÆ.

Genus PLANORBIS Geoffroy, 1767.

Shell discoidal, biconcave, with the whorls visible on both sides: aperture small, rounded, oblique; peristome simple, generally thin; columella wanting. Jaw with three segments; foot straight, obtuse in front and behind.

Type, *P. corneus* Linnæus.

Planorbis guadaloupensis Sowerby. Plate 53, figs. 11, 12.

Planorbis guadaloupensis Sowerby, Gen., iv, p. 2 (no pagination), pl. ii (plates not numbered), fig. 2, 1821.

Shell large, compressed, with six slowly increasing whorls, which are rounded on both sides and have very delicate incremental and revolving sculpture only visible under a glass; shining, ashy or horn-colored; aperture rounded, thin but slightly oblique; parietal callus distinct and well advanced on the penultimate whorl.

Greater diameter, 25; lesser, 21; height, 7 mm.

Rio Caguitas, Caguas, Porto Rico; several living specimens; also Santo Domingo; Guadaloupe.

Planorbis tumidus Pfeiffer.

Planorbis tumidus Pfeiffer, Weigm. Arch., i, p. 354, 1839.
Planorbis caribæus d'Orbigny, Moll. Cuba, i, p. 193, pl. xiii, figs. 17, 19, 1842.

Porto Rico and Vieques (Crosse); Havana, Cuba; Mexico; southwestern United States; Florida.

Planorbis riisei Dunker.

Planorbis riisei Dunker & Clessin, Conch. Cab., Neue Ausg., Planorbis, p. 110, pl. xvii, fig. 7, 1886.

Porto Rico (Crosse); Jamaica.

Planorbis refulgens Dunker.

Planorbis refulgens Dunker, P. Z. S., 1853, p. 54.
Planorbis refulgens Dunker & Clessin, Chemnitz, Neue Ausg., p. 106, pl. xviii, fig. 10, 1886.

Porto Rico (Crosse); Santo Domingo; Jamaica.

Planorbis haldemani C. B. Adams.

Planorbis haldemani C. B. Adams, Cont. to Conch., p. 43, 1849.

Humacao; Luquillo; Rio Blanco, Porto Rico (Crosse); Jamaica.

Planorbis schrammi Crosse.

Planorbis schrammi Crosse, Journ. de Conchyl, xii, p. 153, pl. vii, fig. 2, 1864

Rio Añasco; Porto Rico (Crosse); Guadaloupe.

Planorbis lucidus Pfeiffer.

Planorbis lucidus Pfeiffer, Weigm. Arch., i, p. 354, 1839.

Humacao; Luquillo, Porto Rico (Crosse); Cuba; Jamaica; Guadaloupe.

Planorbis macnabianus C. B. Adams.

Planorbis macnabianus C. B. Adams, Cont. to Conch., p. 43, 1849.

Near San Juan, Porto Rico (Crosse); Jamaica.

Planorbis circumlineatus Shuttleworth.

Planorbis circumlineatus Shuttleworth, Diagn. Neue Moll. Berner Mitth., 1854, p. 96.

Near Humacao; Rio Blanco, Porto Rico (Crosse); Santo Domingo; St. Thomas.

Genus PLANORBULA Haldeman, 1842.

Planorbula albicans Pfeiffer.

Planorbis albicans Pfeiffer, Weigm. Arch., i, p. 354, 1839.

Porto Rico (Crosse); St. Thomas; Cuba.

Family ANCYLIDÆ.

Genus ANCYLUS Geoffroy, 1767.

Ancylus obscurus Haldeman.

Ancylus obscurus Haldeman, Monog. Limnæidæ, p. 9, pl. I, fig. 3, 1844.

Humacao, Porto Rico (Crosse); St. Thomas; Jamaica; eastern United States

Ancylus beaui Bourguignat.

Ancylus beaui Bourguignat, Journ. de Conchyl., IV, p. 176, 1853.
Ancylus beaui Clessin, Chemnitz, n. ed., p. 69, pl. VII, fig. 10.

Near Luquillo, Porto Rico (Crosse); Guadeloupe.

Family PHYSIDÆ.

Shell spiral, thin, horn-colored, sinistral; outer lip simple, sharp; tentacles acute, elongate; dentition complex.

Genus APLEXA Fleming, 1828.

Shell sinistral, thin, brilliant, apex pointed; whorls but slightly rounded; aperture somewhat elongated; columella slightly twisted.

Type, *Physa hypnorum* Linnæus.

Aplexa sowerbyana d'Orbigny. Plate 54, fig. 11.

Physa sowerbyana d'Orbigny, Moll. Cubana, I, p. 190, pl. X, figs. 11, 13, 1842.

Shell oblong-ovate, polished, dull amber, lighter when young; spire elevated, acuminate; columella thin, slightly tortuous.

Length, 14; diameter, 8 mm.

Rio Caguitas, Caguas, Porto Rico. A number of young specimens were obtained. Also found in Cuba, Jamaica, St. Thomas, and Guadaloupe.

Suborder STYLOMMATOPHORA.

Superfamily DITREMATA.

(VASOPULMONATA.)

Family ONCHIDIIDÆ.

Genus ONCHIDELLA Gray, 1850.

Animal with the dorsal surface nonpapilliferous, ovate, leathery, with no shell in the adult state; respiratory orifice above and on right side of vent, genital orifice to right of tentacles.

Type, *O. nigricans* Quoy & Gaimard.

Onchidella floridana Dall.

Onchidium floridanum Dall, Proc. U. S. Nat. Mus. 1885, p. 288.
Onchidium (*Oncidiella*) *transatlanticum* Heilprin, Proc. Acad. Nat. Sci. Phila. for 1888, p. 327, pl. 15, figs. 4, 4a; Pilsbry, Trans. Conn. Acad., X, p. 503, 1900.

Guanica, Porto Rico; Knights Key, Florida; Bermuda.

This form is stated by Sir Charles Eliot, of the British Legation, to be almost indistinguishable from *O. nigricans* Quoy & Gaimard, which he collected abundantly at Auckland, New Zealand. One specimen was obtained at Guanica by the United States Fish Commission.

Family VERONICELLIDÆ.

Genus VERONICELLA Blainville, 1817.

Body long, without shell or furrow above the margin of the foot; moderately rounded above, flattish below, the sole divided longitudinally into three areas by impressed lines; nocturnal.

Veronicella occidentalis Guilding.

Onchidium occidentale Guilding, Trans. Linn. Soc., XIV, p. 322, pl. XXXI, figs. 8-12, 1825.

Animal plumbeous or brownish, faintly pustulous, sometimes blackish; base lighter, often mottled with black; foot narrow. Length (in spirit), 45; breadth, 14 mm.

Añasco; Caguas; Porto Rico.

(**ORTHURETHRA.**)

Family PUPIDÆ.

Genus BIFIDARIA Sterki, 1891.

Bifidaria pellucida Pfeiffer.

Pupa pellucida Pfeiffer, Symb. I, 1841, p. 46.

Porto Rico, generally; Vieques (Crosse); West Indies, generally; Yucatan; Texas.

Genus PUPOIDES Pfeiffer, 1854.

Pupoides marginatus Say.

Cyclostoma marginata Say, Jour. Acad. Phila., II, p. 172, 1821; Am. Journ. Conch., III, pl. XV, fig. 11.

Fajardo, Porto Rico; eastern United States; several of the West Indies. It is almost certain that the *Bulimus nitidulus* of Pfeiffer (Weigm. Arch., I, 1839, p. 352) is this species. Only a brief Latin description is given, which, however, agrees well with this species, and Reeve's description and figure in the Conchologia (V, 1849, Bulimus, 588) fit it exactly.

Genus VERTIGO Müller, 1774.

Vertigo hexodon C. B. Adams.

Pupa hexodon C. B. Adams, Cont. to Conch., p. 37, 1849.

Humacao, Porto Rico (Crosse); Jamaica.

(**HETERURETHRA.**)

Elasmognatha.

Family SUCCINEIDÆ.

Shell oblique, sometimes flattened, paucispiral, thin, subtransparent, and unicolored.

Genus SUCCINEA Draparnaud, 1801.

Shell oval, fragile; spire short; whorls few and rapidly enlarging; aperture oval; outer lip thin, not reflected, united below by a broad curve with the thin, smooth columella.

Section TAPADA Studer, 1830.

Succinea hyalina Shuttleworth. Plate 54, fig. 15.

Succinea hyalina Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 56.

Shell shining, with rather strong, rude growth lines, short and inflated; whorls scarcely three, rapidly increasing; spire short; suture well defined but not deep; aperture large, regularly oval, much wider below. Color pale buff, the alcoholic specimen showing iridescent tints.

Length, 10; diameter, 6.5; length of aperture, 7.5; diameter, 5 mm.

Caguas, one specimen taken alive.

Succinea approximans Shuttleworth.

Succinea approximans Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 55.

Porto Rico, common (Crosse).

Succinea riisei Pfeiffer.

Succinea riisei Pfeiffer, Zeits. für Mal., X, 1853, p. 52.

Quebradillas, Porto Rico (Crosse); Santa Cruz.

(SIGMURETHRA.)

Aulacopoda.

Family ZONITIDÆ.

Genus VITREA Fitzinger, 1833.

Vitrea insecta von Martens.

Hyalina insecta E. von Martens, Jahrb. d. Deutsch. mal. Ges., IV, 1877, p. 345, pl. XII, fig. 3.

Caguana, near Utuado, Porto Rico (Crosse).

Bland reported *Vitrea indentata* from Porto Rico. Crosse states that this species is near to *indentata*, but perfectly distinct, and that it was probably the *insecta* that Bland mistook for *indentata*.

Vitrea bryodes Shuttleworth.

Zonites bryodes Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 36.

This species has never been figured. Its generic position is a little uncertain, as is that of the preceding species. It is reported from various localities in Porto Rico (Crosse).

Genus ZONITOIDES Lehmann, 1862.

Zonitoides minusculus Binney.

Helix minuscula Binney, Bost. Journ. Nat. Hist., III, p. 345, pl. XXII, fig. 4, 1843.

Fajardo; Humacao, Porto Rico (Crosse).

Widely distributed over the United States, parts of Mexico, and various West Indian islands.

Genus GUPPYA Mörch, 1867.

Guppya gundlachi Pfeiffer.

Helix gundlachi Pfeiffer, Arch. für Naturg. I, 1840, p. 250.

Porto Rico, numerous localities; Vieques (Crosse); Santo Domingo; St. Thomas; Cuba; Nicaragua; Florida.

(AGNATHOMORPHA.)

Family GLANDINIDÆ.

Genus GLANDINA Schumacher, 1817.

Shell elongated with elevated, conical spire and lengthened body whorl, with the base usually attenuated; whorls but slightly rounded; aperture elongate, wider below; outer lip scarcely thickened; columella curved and inrolled, truncate at its base.

Type, *Glandina olivacea* Schumacher.

Glandina portoricensis Pfeiffer.

adina portoricensis Pfeiffer, P. Z. S. 1848, p. 111.
atina riisei Pfeiffer, Chemnitz, Conch. Cab., n. ed., Achatina, pl. LXVII, figs. 3, 4.

Porto Rico, many localities (Crosse).

Glandina terebræformis Shuttleworth.

lina terebræformis Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 52.

Ceiba; Rio Blanco; Vega Baja, Porto Rico (Crosse); Santo Domingo.

Glandina sulculosa Shuttleworth.

sulculosa Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 52.

Juan; Humacao; Utuado, Porto Rico (Crosse).

Glandina interrupta Shuttleworth.

interrupta Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 51.

stern part of Porto Rico (Crosse).

Glandina glabra Pfeiffer. Plate 53, fig. 9.

Achatina (*Glandina*) *glabra* Pfeiffer, Symb. Hel., III, 1846, p. 90.

Shell thin, smooth, shining, light corneous, with distant reddish strigations which fade out on the body whorl; whorls 8; suture distinct, finely crenulately margined; outer margin of the aperture not incurved in the middle.

Length, 28; diameter, 12 mm.

Under rocks in pastures, Bayamon, Porto Rico. One broken specimen.

Family CIRCINARIDÆ.

Genus CIRCINARIA Beck, 1837.

Shell thin, widely umbilicated, depressed, striate or wrinkled, generally uniform in color; whorls 4 to 5, the last broad, moderately deflexed in front; peristome slightly thickened.

Type, *Helix concava* Say.

Circinaria concolor Férussac. Plate 54, figs. 8, 10.

Helix concolor Férussac, Hist. Nat. Moll. Terr., 208, pl. 82, fig. 2, 1821.

Shell widely umbilicated, subdiscoidal, smooth, dark chocolate brown, feebly strigate with lighter brown; suture linear; whorls 4, rapidly increasing, the last obliquely depressed above; base convex.

Diameter, 22; height, 9 mm.

Bayamon, Porto Rico.

Holopoda.

Family STENOGYRIDÆ.

This group is frequently called *Achatinidæ*.

Genus LEPTINARIA Beck, 1837.

Leptinaria antillarum Shuttleworth.

Leptinaria antillarum Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 50 (unfigured).

Humacao, Porto Rico (Crosse); Tortola, Guadeloupe.

Leptinaria stylodon Shuttleworth.

Leptinaria stylodon Shuttleworth, Diagn., neue Moll. Berner Mitth., 1854, p. 50 (unfigured).

Humacao, Porto Rico (Crosse).

Leptinaria opalescens Shuttleworth.

Leptinaria opalescens Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 50.

San Juan; Ceiba; Humacao, Porto Rico (Crosse).

Genus STENOGYRA Shuttleworth, 1854.

Small, elongated, translucent, many whorled, shells with an obtuse summit and simple peristome; mostly oviparous, laying very large eggs for the size of the shell.

Stenogyra terebraster Lamarck.

Bulimus terebraster Lamarck, An. sans Vert., VI, p. 124, 1822; Lister, Hist., pl. 20, fig. 15?

Porto Rico, numerous localities (Crosse); Cuba.

Stenogyra swiftiana Pfeiffer.

Bulimus swiftianus Pfeiffer, Monog. Hel., III, p. 399, 1853; Conch. Cab. *Bulimus*, pl. 69, figs. 9–11.

Porto Rico, many localities; Vieques (Crosse); St. Thomas.

Genus OPEAS Albers, 1850.

Opeas subula Pfeiffer.

Achatina subula Pfeiffer, Arch. für Naturg., I, 1839, p. 352.
Stenogyra subula Binney, Man. Am. L. Shells, p. 425, fig. 473, 1885.

San Juan; Fajardo, Porto Rico (Crosse); Santo Domingo; Cuba; Jamaica; Barbados; Antigua; St. John; St. Thomas; Mexico; Alabama; Cochin China.

Opeas micrus d'Orbigny.

Helix micra d'Orbigny, Mag. de Zoöl., 1835, p. 9, No. 49; Voy. Am. Mér., p. 262, pl. XLI *bis*, figs. 18, 19.

Eastern Porto Rico; Vieques (Crosse); Cuba; Jamaica; Barbados; St. John; St. Thomas; Florida; South Carolina; Bolivian Andes; Rio Janeiro.

Opeas margaritaceus Shuttleworth.

Stenogyra (*Opeas*) *margaritacea* Shuttleworth, Diagn. Neue Moll. Berner Mitth., 1854, p. 47 (unfigured).

Rio Blanca in the Sierra de Luquillo, Porto Rico (Crosse).

Opeas alabastrinus Shuttleworth.

Stenogyra (*Opeas*) *alabastrina* Shuttleworth, Diagn. Neue Moll. Berner Mitth., 1854, p. 47 (unfigured).

San Juan, Porto Rico (Crosse).

Opeas gompharium Shuttleworth.

Stenogyra (*Opeas*) *gompharium* Shuttleworth, Diagn. Neue Moll. Berner Mitth., 1854, p. 47 (unfigured).

San Juan, Porto Rico (Crosse).

Opeas goodallii Miller.

Helix goodallii Miller, Ann. of Phil., VII, p. 381, 1822.
Bulimus goodallii Reeve, Conch. Icon., pl. LXXXIV, fig. 621, 1849.

Various localities in Porto Rico (Crosse).

Genus SUBULINA Beck, 1837.

Shell diaphanous, elongated, subcylindrical, with obtuse summit; whorls numerous; aperture oval; columella twisted, subarcuate and truncated below.

Type, *Subulina sulcata* Gray.

Subulina octona Bruguière.

Bulimus octona Bruguière, Enc. Méth., I, p. 325, No. 47, 1789; Chemnitz, Conch. Cab., IX, p. 90, pl. CXXXVI, fig. 1264.

This common and widely distributed species has from 8 to 9 well-rounded whorls, having delicate striæ, which are more strongly developed in the deep suture, where they often form faint denticulations. When fresh the shell is horn colored and shining.

Caguas; under rocks in pastures, Bayamon; Ensenada Honda, Culebra; also West Indies generally, Mexico, and Central and South America.

This with other *Stenogyridæ* has no doubt been carried about the world on banana plants.

Subulina acicularis Shuttleworth.

Stenogyra (*Subulina*) *acicularis* Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 49.

Fajardo, Porto Rico (Crosse).

Genus SPIRAXIS C. B. Adams, 1850.

Spiraxis paludinoides d'Orbigny.

Achatina paludinoides d'Orbigny, Moll. Cubana, I, p. 171, pl. XI, figs. 13–15, 1841.

Aguadilla, Porto Rico (Crosse); Cuba; Jamaica.

Genus PSEUDOBALEA Shuttleworth, 1854.

Pseudobalea dominicensis Pfeiffer.

Balea dominicensis Pfeiffer, P. Z. S., 1851, p. 140; Mon. Hel. Viv., IV, p. 454 (unfigured).

Porto Rico, many localities (Crosse); Haiti; Cuba, at Bayamon (Gundlach).

Family CLAUSILIIDÆ.

Genus CLAUSILIA Draparnaud, 1805.

Shell elongated, many whorled, generally reversed; aperture oval or pear shaped, with a sinus above; peristome with a continuous border; columella oblique, furnished with lamella. The aperture is provided with a movable, shelly plate.

Type, *Clausilia plicatula* Draparnaud.

Section NENIA H. & A. Adams, 1855.

Clausilia bicanaliculata Férussac. Plate 54, fig. 14.

Clausilia bicanaliculata Férussac, Tableau, p. 62, No. 523, 1821.
Turbo tridens auctorum, as of Chemnitz; *Clausilia costulata* Lamarck, 1822; and *Clausilia labiata* Sowerby, not Dillwyn.

Shell with a slight umbilical depression, with about eight scarcely rounded whorls, the apex decollated, the last whorl much constricted and drawn out into a neck; sculpture of two kinds: a series of longitudinal, curved, rather strong ridges crossing which are oblique fine wrinkles; aperture directly in line with the axis of the shell, strongly reflexed, white, with two sharp, curved plications on the columella. The general color of the shell is a pale brown.

Length, 27; diameter, 5; of aperture, 6 mm.

El Yunque; Cayey, Porto Rico.

A member of a genus having over 700 species, its metropolis being in southeastern Europe. It is well represented in Japan, southeast Asia, and the East Indian Archipelago. Quite a number of species are found in western South America, and this single form inhabits the West Indies and is confined to Porto Rico.

Family UROCOPTIDÆ.

Genus PINERIA Poey, 1854.

Pineria viequensis Pfeiffer.

Bulimus viequensis Pfeiffer, Mal. Blatt., III, p. 46, 1856; Novit. Conch., III, pl. 93, figs. 39–41.

Island of Vieques (Pfeiffer).

Genus CERION Bolten, 1798.

Shell rimate, cylindrical, or pupiform, generally vertically ribbed, solid; whorls scarcely rounded, the upper tapering rapidly to a point, the last narrowed at the base, usually ascending; aperture rounded, subquadrate, or oval, pointed above; peristome thick, reflexed; columella nearly always bearing a dentiform fold, and the parietal wall having a denticle.

Type, *Turbo uva* Linn.

Subgenus STROPHIOPS Dall, 1894.

Cerion crassilabre Sowerby.

Pupa crassilabris Sowerby, Conch. Icon., XX, Pupa 14, pl. II, fig. 14, 1875.

Porto Rico; Virgin Islands. According to Pilsbry and Vanatta (Proc. Acad. Nat. Sci. Phila. 1896, p. 324) this species is found in Porto Rico. It is not given in the list of Crosse or Gundlach.

Cerion striatellum (Férussac) Guerin. Plate 53, fig. 4.

Pupa striatella Ferussac Mss. in Guerin, Icon. du Règne Anim. Moll., p. 16, pl. 6, fig. 12, 1832; Küster, Conch. Cabinet, Pupa, pl. 10, figs. 14, 15.

Shell rather short, cylindrical, with a rounded blunt summit; whorls about nine, scarcely convex, the first one and one-half to two smooth, milk white to corneous, the remainder with very numerous fine ridges, which are oblique above and vertical on the lower whorls; surface white or white variously blotched with horn color; aperture rather small, rounded or subquadrate, having a small, revolving, deep-seated lamellar tooth on the columella, and a short lamellar one on the parietal wall, white or brownish within; peristome moderately thickened, reflexed; base rounded and ending in an ill defined ridge around the small umbilical perforation.

Length, 23; diameter, 10; greatest length of aperture, 7 mm.

Cabo Rojo Light; Ponce, Porto Rico. The specimen from Ponce is longer, more tapering above, and more strongly ribbed than the shells from Cabo Rojo, and has ten whorls. The material examined agrees very well with the original description of *Pupa striatella*, and it is quite probable that it is that species. The material from Porto Rico collected by the Fish Commission belongs to the subgenus *Strophiops*. It certainly differs much from the description and figure of *Pupa crassilabris* in the Conchologia Iconica, which has a double lip. We have numerous specimens from Porto Rico, Tortola, and Anguilla in the National Museum collection, none of which have a double lip.

Pilsbry and Vanetta place *Cerion striatellum* in the subgenus *Diacerion*, and credit it to Cabo Cruz, Cuba, only.

Cerion microstoma Pfeiffer (var.).

Pupa microstoma Pfeiffer, Mal. Blatt., I, p. 207, pl. III, figs. 15, 16, 1854.

Given in Crosse's list as a Porto Rican species on the authority of Pfeiffer. Crosse states that it is only the variety which comes from this island, the type being found in Cuba.

Genus MACROCERAMUS Guilding, 1828.

Macroceramus microdon Pfeiffer.

Bulimus microdon Pfeiffer, P. Z. S., 1851, p. 261.

San Juan, Porto Rico (Crosse); St. Thomas; St. John.

Macroceramus shuttleworthi von Martens.

Macroceramus shuttleworthi E. von Martens, Jahrb. d. d. Malak. Ges., IV, p. 352, 1877.
Macroceramus microdon var. β Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 53.

Penuelas, Porto Rico (Crosse).

Macroceramus johannis Pfeiffer.

Macrocramus johannis Pfeiffer, Mal. Blatt., XXII, 1875, p. 119.

Aguadilla, Porto Pico.

Genus BRACHYPODELLA Beck, 1838.

Section BRACHYPODELLA s. s.

Brachypodella pallida Guilding.

Brachypus pallidus Guilding (MS.), *Cylindrella pallida* Pfeiffer, in Philippi, Abbild., II, p. 52, pl. II, fig. 14, 1845.

Near San Juan; Vega Baja; Penuelas, Porto Rico (Crosse); St. Thomas; Jamaica.

Brachypodella portoricensis Pfeiffer.

Cylindrella portoricensis Pfeiffer, Zeits. für Mal., IX, 1852, p. 151; Conch. Cab. *Cylindrella*, pl. IV, figs. 14–15.

Porto Rico, various localities (Crosse).

Brachypodella riisei Pfeiffer.

Cylindrella riisei Pfeiffer, Zeits. für Mal., IX, 1852, p. 133; Conch. Cab. *Cylindrella*, pl. V, figs. 18–20.

Porto Rico, many localities (Crosse).

Family BULIMULIDÆ.

Subfamily AMPHIBULIMINÆ.

Genus SIMPULOPSIS Beck, 1837.

Subgenus Platysuccinea Ancey, 1881.

Simpulopsis portoricensis Shuttleworth.

Simpulopsis portoricensis Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 55.

Sierra de Luquillo, Porto Rico, abundant on leaves of bananas (Crosse).

Simpulopsis psidii von Martens.

Bulimus (*Eudioptus*) *psidii* E. von Martens, Jahrb. d. Deutsche Malak. Ges., IV, p. 351, pl. XII, fig. 6, 1877.

Caguana, near Utuado, Porto Rico (Crosse).

Genus GÆOTIS Shuttleworth, 1854.

Gæotis nigrolineata Shuttleworth.

Gæotis nigrolineata Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 127.

Sierra de Luquillo, Porto Rico, on banana leaves (Crosse).

Gæotis flavolineata Shuttleworth.

Gæotis flavolineata Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 127.

Sierra de Luquillo; Arecibo; Utuado, Porto Rico (Crosse).

Gæotis malleata Pilsbry.

Gæotis malleata Pilsbry, Manual, 2d ser., XII, p. 230, pl. LXII, figs. 36–40, 1899.

Near San Juan, Porto Rico (Pilsbry).

Gæotis albopunctulata Shuttleworth.

Gæotis albopunctulata Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 36.

Humacao, Porto Rico, on tree trunks (Crosse).

Subfamily BULIMULINÆ.

Genus BULIMULUS Leach, 1815.

Shell varying from ovate-conic to oblong, columnar or lanceolate, umbilicate or imperforate; aperture with the lip thin, generally not expanded; columella expanded, rather straight; apical whorls either smooth, vertically costulate, or with the wrinkles interrupted and broken into granules.

Type, *Bulimulus exilis* Gmelin.

Subgenus BULIMULUS s. s.

Bulimulus exilis Gmelin. Plate 53, fig. 3.

Helix exilis Gmelin, Syst. Nat., p. 3668, 1792.

Shell narrowly perforated, somewhat elongated, thin to solid, dirty white or whitish with purple-brown spire and base, often with from one to three dark revolving bands, the upper and lower wide; surface nearly smooth; whorls about six, the first two delicately zigzag striate; sutures well marked; aperture about two-fifths length of shell, showing within markings of exterior; outer lip scarcely thickened or reflected; columella nearly straight, reflexed so as to partially cover umbilical opening.

Height, 20; diameter, 9; height of aperture, 9 mm.

Aguadilla; San Juan, Porto Rico.

Bulimulus exilis var. **eyriesii** Drouet.

Bulimus eyriesii Drouet, Ess. Moll. Terr. Fluv. Guyane Fran., p. 63, pl. I, figs. 12, 13, 1859.

This form is slightly thinner than the type, is never banded but is nearly uniform colored and shows faint revolving striæ. The lower part of the shell is generally a little wider than the type.

San Juan, Porto Rico.

Bulimulus diaphanus Pfeiffer. Plate 53, fig. 6.

Bulimus diaphanus Pfeiffer, P. Z. S., 1854, p. 125.

Shell perforate, thin, fragile, covered with a delicate, horn-colored epidermis, which is pinched up throughout into broken, revolving liræ; whorls six, somewhat rounded; the apex punctately reticulated; aperture ovate, about three-sevenths of the length of the shell; outer lip thin, not expanded; columella reflexed over the umbilicus.

Height, 16; diameter, 7 mm.

Under rocks in pastures, Bayamon, Porto Rico; Caguas, under bricks in a garden.

Genus DRYMÆUS Albers, 1850.

Shell ovate or oblong, with conic spire, umbilicate or imperforate, rather thin; aperture triangular to ovate; lip simple or expanded; apical whorls with a minute, even grating of longitudinal and spiral striæ. Type, *Drymæus hygrohylæus* d'Orbigny.

Subgenus DRYMÆUS s. s.

Drymæus hjalmarsoni Pfeiffer.

Bulimus hjalmarsoni Pfeiffer, Mal. Blätt., III, p. 51, 1856 (unfigured).

Pajas plantation, near Manati, Porto Rico (Crosse).

Drymæus liliaceus Férussac. Plate 53, fig. 10.

Helix (Cochlogena) liliacea Férussac, Prodr., 1821, p. 54; Hist. Nat. Moll. Terr., pl. 142 B, fig. 11.

Shell perforate, rather solid, shining, cretaceous or milky white, sometimes stained with bluish; whorls six and one-half to seven, scarcely rounded, with very fine, revolving, incised lines, the last somewhat swollen at the base; aperture ovate; peristome scarcely expanded, not thickened; columella deeply entering, slightly sinuous, reflected and pressed in over the umbilicus.

Height, 30; diameter, 14; length of aperture, 13 mm.

Cayey, Porto Rico. Many specimens living, mostly young.

Drymæus elongatus Bolten. Plate 53, fig. 5.

Helix elongata Bolten, Mus. Boltenianum, 1st ed., p. 107, 1798.

Shell perforate, solid, with delicate growth lines and sometimes with faint traces of revolving sculpture, white, salmon-colored, ashy or buff, often with three bands of dark color, which may be entire or broken, sometimes longitudinally streaked with brown; whorls six or seven, somewhat rounded; aperture ovate; peristome thick, slightly reflexed, advanced in the middle, showing within the outside pattern of coloring; columella faintly sinuous, often dark brown.

Height, 30; diameter, 14; length of aperture, 15 mm.

Hucares, Porto Rico, brownish and streaked varieties; Culebra Island, white variety.

Family HELICIDÆ.

Subfamily SAGDINÆ.

Genus THYSANOPHORA Strebel & Pfeffer, 1880.

Thysanophora dioscoricola C. B. Adams.

Helix dioscoricola C. B. Adams, Proc. Bost. Soc. Nat. Hist., 1845, p. 16.
Zonites dioscoricola Tryon, Manual, II, p. 174, pl. LIII, figs. 46, 47, 1886.

Island of Vieques; Jamaica; the variety *cæca* in Florida, Texas, and Trinidad.

Thysanophora plagioptycha Shuttleworth.

Helix plagioptycha Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 37.
Zonites plagioptycha Tryon, Manual, II, p. 174, pl. LIII, fig. 51, 1886.

Humacao; Fajardo; Ceiba; Rio Blanco, Porto Rico; island of Vieques; the variety *granum* in Florida, Mexico, and Yucatan.

Thysanophora krugiana von Martens.

Helix (Microphysa) krugiana E. von Martens, Jahrb. d. Deutsche Malak Ges., IV, p. 346, pl. XII, fig. 4, 1877.

Caguana, near Utuado.

Thysanophora vortex Pfeiffer.

Helix vortex Pfeiffer, Arch. für Naturg., I, 1839, p. 351.
Helix vortex Tryon, Manual, III, p. 98, pl. XIX, figs. 25–28, 1887.

Porto Rico, many localities (Crosse); island of Vieques; St. Thomas; Barbados; St. Croix; Cuba; Santo Domingo; Florida.

Thysanophora subaquila Shuttleworth.

Helix subaquila Shuttleworth, Diagn. neue Moll. Berner Mitth. 1854, p. 37.
Helix subaquila Tryon, Manual, III, p. 98, pl. XIX, fig. 31, 1887.

Porto Rico generally; Vieques (Crosse); St. Thomas.

Thysanophora euclasta Shuttleworth.

Helix euclasta Shuttleworth, Diagn. neue Moll., Berner Mitth., 1854, p. 38.
Helix euclasta Tryon, Manual, III, p. 97, pl. VIII, fig. 65, 1887.

Ponce, Porto Rico; Vieques; St. Thomas; Cuba.

Crosse states that only one of the varieties of this species has been found in Porto Rico.

Thysanophora musicola Shuttleworth.

Helix musicola Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 38.
Helix musicola Tryon, Manual, III, p. 97, pl. VIII, fig. 66, 1887.

Porto Rico, many localities (Crosse).

Thysanophora portoricensis Pfeiffer.

Helix portoricensis Pfeiffer, Zeits. für Malak., IV. p. 13, 1847.
Helix portoricensis Tryon, Manual, III, p. 96, pl. XIX, figs. 11, 12, 1887.

Porto Rico (Tryon).

Thysanophora velutina Lamarck.

Helix velutina Lamarck, An. sans Vert., VI, pt. 2, 1822, p. 86.
Helix velutina Tryon, Manual, III, 1887, p. 100, pl. XXII, figs. 30–32.

Humacao, Porto Rico (Crosse).

Thysanophora arecibensis Pfeiffer.

Helix arecibensis Pfeiffer, Mal. Blätt., III, p. 44, 1856.
Helix arecibensis Tryon, Manual, III, p. 58, pl. X, figs. 57–59, 1887.

Arecibo, Porto Rico (Tryon).

Subfamily HELICINÆ.

Genus CEPOLIS Montfort, 1810.

Section JEANNERETIA Pfeiffer, 1877.

Cepolis dermatina Shuttleworth.

Helix dermatina Shuttleworth, Diagn. neue Moll. Berner Mitth. 1854, p. 41.
Cepolis dermatina Tryon, Manual, V, p. 50, pl. X, fig. 93, 1889.

Luquillo, on bananas; Quebradillas, Porto Rico (Pilsbry).

Cepolis squamosa Férussac.

Helix squamosa Férussac, Prodr., 1821, p. 36; Hist. Nat. Moll. Terr., pl. 41, fig. 3.
Cepolis squamosa Pilsbry, Manual, V, p. 95, pl. LVI, figs. 20–22, 1889.

San Juan and Luquillo, Porto Rico (Pfeiffer).

Section PLAGIOPTYCHA, Pfeiffer, 1856.

Cepolis riisei Pfeiffer.

Helix riisei Pfeiffer, Mal. Blätt., III, p. 44, 1856.
Cepolis riisei Pilsbry, Manual, V, p. 16, pl. XI, figs. 33, 34, 1889.

Island of Vieques (Crosse).

Cepolis diaphana Lamarck.

Helix diaphana Lamarck, An. sans Vert., VI, pt. 2, p. 85, 1822.
Cepolis diaphana Pilsbry, Manual, V, p. 22, pl. XI, fig. 8; pl. XIX, figs. 51, 52, 1889.

Porto Rico, many localities; island of Vieques.

Subfamily CAMÆNINÆ.

Genus PLEURODONTE Fischer de Waldheim, 1808.

Shell rather large and solid, depressed globose to lenticular, often toothed; periphery rounded or keeled; striate or granular, usually dark colored; jaw solid, arcuate.

Subgenus PLEURODONTE s. s.

Section CARACOLLUS Montfort, 1810.

Pleurodonte carocolla Linnæus. Plate 54, fig. 7.

Helix carocolla Linnæus, Syst. Nat., ed. 10, p. 769, 1758; Chemnitz, Conch. Cab., IX, p. 95, pl. 125, figs. 1090, 1091.

This species, one of the largest and finest of the genus, is finely ribbed below and slightly granulous on the upper whorls. The sutures are scarcely impressed; it is always sharply keeled and is of a nearly uniform chestnut color throughout, the interior and lip being lighter.

Height, 25; diameter, 55 mm.

San Juan; Caguas; El Yunque, Porto Rico.

Pleurodonte bornii Pfeiffer. Plate 54, figs. 2, 3.

Helix bornii Pfeiffer, Conch. Cab., neue Ausg., pl. 8, figs. 5, 6, 1846; Mon. Hel. Viv., I, p. 391, 1848.

Possibly only a variety of *P. marginella* Gmelin, which is distributed through eastern Cuba. There are two forms in Haiti which may be only varieties of *P. marginella. P. bornii* has delicate revolving striæ which cut the upper surface of the shell into very fine granules. The umbilicus is wide; and there is a single, revolving, dark brown band above and below on a light ground.

Height, 15; diameter, 37 mm.

Caguas; San Juan, Porto Rico.

Subgenus POLYDONTES Montfort, 1810.

Section PARTHENA Albers, 1850.

Pleurodonte angulata Férussac. Plate 54, fig. 1.

Helix angulata Férussac, Prodr., No. 134, 1821; Hist. Nat. Moll. Terr., pl. 61, fig. 2.

Shell imperforate, lenticular, thin, slightly rounded above, more inflated below, especially in umbilical region; whorls four, rapidly increasing, flat, with strong growth lines, slightly granulous above and below; suture not at all impressed; periphery sharply keeled; aperture but slightly oblique, its lip reflected above and below; columella curved, deeply inserted; parietal callus thin. The general color of the shell is milky white, and when fresh it is covered with a very thin horn-colored epidermis. There are sometimes faint traces of revolving lines of color on the under surface.

Height, 20; greater diameter, 45; lesser, 34 mm.

El Yunque, Porto Rico.

Pleurodonte obliterata Férussac.

Helix obliterata Férussac, Prodr., p. 136, 1821; Hist. Nat. Moll. Terr., pl. 61, fig. 3.
Pleurodonte obliterata Pilsbry, Manual, v, p. 69, pl. VI, figs. 51, 52. 1889.

Closely allied to *P. angulata*, but is heavier, less inflated below, and does not have so sharp a keel. There are some half dozen revolving color bands on the base of the shell. This fine species is not given in Crosse's list, but is found in Porto Rico according to Pilsbry.

Section LUQUILLIA Crosse, 1892.

Pleurodonte luquillensis Shuttleworth. Plate 2, fig. 16.

Helix luquillensis Shuttleworth, Diagn. neue Moll. Berner Mitth., 1854, p. 40.

Shell imperforate, conoidal, elevated, solid, dark, with rather feeble growth lines and covered with a very fine, microscopic reticulation; whorls five and one-half, the earliest scarcely convex, the later ones more rounded; last whorl rounded, flattened on the periphery, and having an almost obsolete carina; aperture oblique, rounded; peristome thick, slightly reflected, white; columella oblique, rather deeply entering, with a faint tooth at its base; parietal wall having a thin callus.

Height, 34; greater diameter, 34; lesser, 30 mm.

El Yunque, Porto Rico.

This fine species is of a nearly uniform dark-chestnut color throughout, but sometimes shows faint, darker spiral bands within the aperture.

Section THELIDOMUS Swainson, 1840.

Pleurodonte lima Férussac. Plate 54, fig. 4.

Helix (*Helicogena*) *lima* Férussac, Prodr., p. 81, 1821; Hist. Nat. Moll. Terr., pl. 46, figs. 1, 2.

A well known and abundant species, closely related to *P. incerta* and *P. castrensis*. The earlier whorls are light colored and but slightly granular, the last whorl is covered with fine, sharp, whitish pustules on an ashy brown ground, sometimes having darker streaks following the growth lines.

Cayey; San Juan; Añasco; Aguadilla; San Geronimo; Catona; Caguas, Porto Rico.

Pleurodonte castrensis Pfeiffer. Plate 54, fig. 5.

Helix castrensis Pfeiffer, P. Z. S., 1856, p. 386.

Shell imperforate, with somewhat elevated spire and swollen base, the upper shell, except the earlier whorls, covered with very fine, revolving sculpture, making the surface reticulated; the base having faint scattered pustules near the aperture; whorls nearly five, slightly convex, the last deflected at the aperture and bluntly carinated, the last two having faint, brown strigations and sometimes subobsolete, revolving bands on a lighter ground; aperture oblique; lip slightly reflexed, white; columella heavy, entering deeply, sometimes feebly toothed.

Height, 15; greater diameter, 25; lesser, 20 mm.

San Juan; near Caguas, Porto Rico.

Pilsbry makes this a variety of *P. lima*, while Crosse considers it a valid species. It seems to stand about midway between *lima* and *incerta*, and might as well or better be called a variety of the latter. *P. incerta* is decidedly granular throughout, has a narrow, dark peripheral band, and is generally higher and less carinate than *P. castrensis*. *P. lima* does not have revolving striæ and is usually less elevated than *castrensis*.

Pleurodonte incerta Férussac.

Helix incerta Férussac, Hist. Nat. Moll. Terr., pl. cv, fig. 2, 1832.
Helix incerta Pilsbry, Manual, v, p. 57, pl. I, figs. 1, 2; pl. IV, figs. 36, 37, 1889.

Not in Crosse's list, but reported from Porto Rico on the authority of Pilsbry.

Superorder STREPTONEURA.

Order CTENOBRANCHIATA.

Suborder ORTHODONTA.

Superfamily TOXOGLOSSA.

Family TEREBRIDÆ.

Genus TEREBRA Bruguière 1789.

Shell elongated, solid, many-whorled; whorls generally flattened; suture shallow; aperture small, notched below; columella without plaits above.

Type *T. subulata* Linnæus.

Section HASTULA H. & A. Adams, 1857.

Terebra cinerea Born.

Buccinum cinereum Born, Test. Mus. Vind., p. 267, pl. x, figs. 11, 12, 1780.

An abundant, widespread species, which is quite variable and has received many names. It is found generally throughout the Indo-Pacific region, the West Coast of Africa, and the West Indies. A single worn specimen was collected by the *Fish Hawk* expedition at Aguadilla, Porto Rico.

Terebra hastata Gmelin.

Buccinum hastatum Gmelin, Syst. Nat., p. 3502, 1792; Tryon, Manual, VII, p. 34, pl. x, fig. 87, 1885.

Porto Rico (Gundlach); West Indies generally.

Section ACUS H. & A. Adams, 1857.

Terebra protexta Conrad.

Terebra protexta Conrad, Proc. Acad. Nat. Sci. Phila., III, p. 26, 1843; Tryon, Manual, VII, p. 25, pl. VI, fig. 98, 1885.

Whorls about fifteen, somewhat rounded, having about eighteen rather sharp, curved ribs, which are made slightly nodulous by numerous revolving liræ; sutural band obscure or wanting; apex smooth for the first two whorls; columella twisted; canal thrown backward; outer lip simple.

Color, brownish or purple brown.

Length, 18 to 20 mm.

Mayaguez Harbor, several young shells; also southern and southeastern United States.

Terebra juanica, n. sp. Plate 57, fig. 5.

Shell minute, slender, acute, with a minute subglobular apex, brilliantly polished, purplish brown with a paler presutural band. Whorls nine, with two additional nepionic turns, which are smooth, pale, and inflated, then the more mature whorls following have at first rather strong, even, slightly flexuous axial ribs extending from suture to suture; these gradually become fainter and on the last whorl obsolete. The only spiral sculpture is a faint groove between the ribs marking the anterior border of the rather obscure sutural band; this groove becomes obsolete also on the anterior whorls. Pillar short, strong, simple, with no indication of any plait.

Length of largest specimen, 7.5; maximum diameter, 1.7 mm.

San Juan Harbor, Porto Rico.

This is perhaps the smallest species of *Terebra* yet described from the West Indies and is notable for its brilliant vitreous polish and obsolete sculpture.

Terebra nassula Dall.

Terebra (*Acus?*) *nassula* Dall, Blake Report, II, p. 66, pl. XXXVI, fig. 8, 1889.

Shell slender, yellowish white or buff, the color paler at the sutural band; whorls eighteen, the nuclear smooth, remainder of the shell uniformly sculptured; in the earlier whorls the band is defined, but in the later ones it is faint; longitudinal ribs numerous, curved; spiral threads rather strong, forming slight nodules on the ribs, fainter on the base; aperture elongated, canal short, twisted.

Length, 55; diameter, 10 mm.

Mayaguez, Porto Rico; Vieques; Culebra. Several specimens were obtained, all young and more or less worn.

Terebra limatula var. acrior Dall. Plate 57, fig. 6.

Terebra limatula var. *acrior* Dall, Blake Report, II, p. 66, 1889.

Four badly broken and worn specimens were obtained at Mayaguez Harbor, Porto Rico.

Family CONIDÆ.

Genus CONUS Linnæus, 1758.

Shell solid obconic; whorls enrolled upon themselves, the spire short, smooth, or tuberculate; aperture elongated, narrow, the margins parallel; lip simple, but having a slight sutural sinus.

? Conus delesserti Recluz.

Conus delesserti Recluz, Mag. de Zool., pl. LXXII, 1843.

A single badly broken and faded specimen from Boca Prieta, Porto Rico, was obtained, but it is not in condition to be identified with certainty.

Conus agassizii Dall.

Conus agassizii Dall, Blake Report, I, 1886, pl. IX, figs. 8, 8*a*, and explanation to plate; II, p. 68, 1889.

Shell spindle-shaped, the outline of the last whorl swollen a little at the middle; entire surface of this whorl except the extreme upper part grooved, the grooves stronger below; lower ridges shouldered; spire high, straight or a little concave; suture distinct, almost channeled; whorls on the spire channeled and sculptured with elegant curved riblets; shoulder sharp and dotted with reddish brown. There are faint revolving series of brown dots on the body whorl, and a few irregular longitudinal brown flames on the spire and body.

Length of specimen obtained, 27; diameter, 14 mm.

Mayaguez, Porto Rico, one fine young shell.

Conus pygmæus Reeve.

Conus pygmæus Reeve, P. Z. S., 1843, p. 179; Kiener, Coq. Vivantes, *Conus*, p. 174, pl. CII, figs. 1, 1*a*, 1*b*, 1848.

Several specimens from Aguadilla, Porto Rico, may be this, but they are too badly worn to be determined with certainty. Reeve's figure in the Conchologia is utterly worthless.

Conus verrucosus Hwass.

Conus verrucosus Hwass, Encyc. Méth., I, pt. II, p. 708, 1792; Kiener, Coq. Vivantes, *Conus*, p. 55, pl. LXVI, figs. 6, 6*a*, 1848.

Shell elongate-conical, with a high spire, composed of about ten grooved whorls; suture deep and distinct; shoulder sharp; body whorl nearly straight, grooved except at extreme upper part, each ridge generally bearing a row of small tubercles. Color whitish, irregularly clouded with brown.

Length, 27; diameter, 12 mm.

Mayaguez Harbor, one shell in fair condition.

Conus mus Hwass.

Conus mus Hwass, Encyc. Méth., pt. II, p. 690, 1792; Tryon, Manual, VI, p. 19, pl. V, figs. 72, 73, 1884.

Shell short, with a low, scarcely concave striate spire, which is often tuberculate; body whorl covered with low, revolving striæ, which become more pronounced at the base; shoulder well defined. Color ashy or greenish white, with longitudinal brown clouding, which is broken so as to leave a light band on the shoulder and another at the middle of the shell. The whole is covered in a fresh state with a thick, dark epidermis.

Length, 30; diameter, 19 mm.

San Juan; San Geronimo; Aguadilla; Ponce, Porto Rico.

An abundant species, distributed throughout the West Indies, Mexico and Central America, and the Florida Keys.

Conus nebulosus Solander.

Conus nebulosus (Solander) Hwass, Encyc. Méth., II, pt. I, p. 607, 1792; Kiener, Coq. Vivantes, *Conus*, p. 16, pl. XXIV, figs. 2, 2*a*, 1848.

Spire elevated, concave, tuberculate, striate; shoulder well defined; body whorl generally somewhat granulous, especially at the base, where there may be elevated revolving tuberculated ridges. Color brownish, painted with irregular white spots and blotches, often so as to form a lighter central band. In some cases the white predominates.

Length, 35 to 65; diameter, 20 to 35 mm.

Aguadilla, Porto Rico, three young worn shells.

A beautiful species, having an almost infinite variety of coloring.

Conus testudinarius Hwass.

Conus testudinarius Hwass, Enc. Méth., I, p. 694, 1792.
Conus porto-ricanus Hwass, op. cit., No. 110, p. 714, II, pl. CCCXXXVIII, fig. 4.

Porto Rico (Kiener).

Family PLEUROTOMIDÆ.

Genus PLEUROTOMA Lamarck, 1822.

Shell turriculated fusiform; spire long, sharp; aperture ovate, columellar margin smooth, the outer lip with a narrow sinus situated at or above the peripheral keel; the operculum clawlike.

Subgenus PLEUROTOMA s. s.

Pleurotoma albida Perry.

Pleurotoma albida Perry, Conch., Expl. pl. XXXII, fig. 4, 1811.

Shell elongated, with about fourteen or fifteen whorls, the first two nearly smooth, the remainder with fine longitudinal threads and strong, revolving ridges, of which there are three on each of the spire whorls, the central one the strongest. On the body whorl are many revolving ridges which become fainter at the base, and throughout the shell there are fine intermediate revolving threads. Sinus rather shallow, wide, placed at second ridge below the suture; canal long, rather narrow. Upper whorls brownish tinted, rest of the shell white; epidermis thin, horn colored.

Length, 100; diameter, 30 mm.

Boca Prieta; Mayaguez, Porto Rico; a number of young specimens of this fine species.

Subgenus ANCISTROSYRINX Dall, 1881.

Whorls concave below the suture, with a wide, deep sinus, bordered externally by an elevated frill, which is directed backward.

Pleurotoma radiata Dall.

Pleurotoma (*Ancistrosyrinx*) *radiata* Dall, Blake Report, II, p. 78, pl. XII, fig. 12, 1889.

Shell clouded pale brown and white, or pale uniform brown; nucleus consisting of two whorls, the first small, oblique and partly immersed, subsequent whorls nine or ten, at first with a sharp, dentate, peripheral keel, which afterwards becomes spinous and posteriorly directed; surface delicately cancellated by spiral threads and growth lines; carina on last whorl with about twenty-six sharp sawtooth-like spines curved upward; halfway between this crown and the suture is a second smooth, sharp keel, and within is a deep sinus; aperture narrow, elongate.

Length, 18; diameter, 8 mm.

Mayaguez Harbor, Porto Rico, one young specimen.

Genus DRILLIA Gray, 1838.

Shell turriculated, with elevated spire, the last whorl generally shorter than the rest of the shell: outer lip thickened; sinus rather deep, rounded, placed a short distance below the suture. Operculum as in *Pleurotoma*.

Drillia ostrearum Stearns.

Drillia ostrearum Stearns, Proc. Bost. Soc. Nat. Hist., XV, p. 22, 1872; Tryon, Man., VI, p. 197, pl. XXXIV, fig. 79, 1884.

Shell with about ten whorls, which are rather narrowly concavely shouldered above, with straight, strong, longitudinal ribs (about eighteen on the last whorl), which are crossed by numerous revolving threads of two sizes. On the last whorl, just behind the outer lip, there is a strong varix, which is continued upward to the suture; aperture moderately short; canal truncated below. Color varying from yellow to blackish.

Length, 18; diameter, 6.5 mm.

St. Thomas, one yellow-colored specimen.

Drillia albicoma Dall.

Drillia albicoma Dall, Blake Report, II, p. 83, pl. X, fig. 8, 1889.

Shell solid, slender, acute, white, with a simple, polished nucleus of a whorl and a half, followed by nine slightly convex whorls, which have rather strong, flexuous, longitudinal ribs that extend from suture to suture; spiral sculpture consisting of exceedingly fine, wavy threads; last whorl having a stout, high varix near aperture; aperture more than one-third the length of shell, narrowed below.

Length, 25; diameter, 8 mm.

Aguadilla, Porto Rico; one broken shell.

Drillia eucosmia var. **canna** Dall.

Drillia eucosmia var. *canna* Dall, Blake Report, II, p. 86, 1889.

Shell pale, with a peripheral lighter zone; whorls eight; longitudinal sculpture consisting of short, stout ribs, beginning at the fasciole and ending below the middle of the whorl; surface covered with revolving threads.

Length, 19; diameter, 6.5 mm.

Mayaguez, Porto Rico; one specimen of the variety *canna*, in bad condition. The variety is smaller and more slender than the type and has three peripheral spirals.

Drillia nigrescens Gray.

Pleurotoma nigrescens (Gray MS.) Reeve, Conch. Icon., I, pl. XXVI, fig. 235, 1845.

Shell solid; whorls with rather a well-defined but low shoulder, above which they are excavated and finely reticulated. Below the suture there is a rather strong, revolving thread. Ribs numerous, fine and nearly straight, beginning at the shoulder and becoming fainter on the base of the body whorl. Between the ribs are strong revolving liræ, which become stronger and sometimes nodulous on the base; varix low; aperture short, truncate below. Color dark purplish or blackish.

Length, 12; diameter, 4.5 mm.

Mayaguez Harbor, Porto Rico; Ensenada Honda, Culebra; several worn shells.

Drillia ? actinocycla, n. sp. Plate 57, fig. 15.

Shell minute, thin, brilliant (the type immature), with about seven convex whorls separated by a deep suture; the first four whorls are smooth polished, nepionic and translucent, those following with numerous narrow deeply concave, emphatic, axial ribs, extending from suture to suture but obsolete on the base of the whorl; these are crossed by numerous fine, equal, evenly distributed spiral grooves with equal threadlike interspaces covering the shell; the later whorls are white with three pale yellow-brown spiral bands, one presutural, one peripheral, and one basal, and wider in that order; pillar straight, white.

Length, 3.5; maximum diameter, 1.5 mm.

Mayaguez, Porto Rico; station 134.

This may prove to be a *Mangilia*, as the aperture is not mature, but is too elegant a shell to pass over on that account.

Drillia gundlachi, n. sp. Plate 57, fig. 17.

Shell solid, slender, pale brown or whitish, with ten whorls (the nepionic whorls lost) strongly appressed at the suture; anal fasciole close to the suture, smooth or faintly spirally striated, rather wide and excavated, notch wide, not very deep; sculpture of about six strong, short, turgid ribs obsolete in front of the periphery and on the last half of the last whorl; these are crossed by from two to five spiral threads stronger on the summits of the ribs, especially the pair which first appear, and faint, finer, spiral striations between the ribs; lines of growth well marked; aperture elongate; outer lip moderately thickened, inner lip and throat white; canal rather wide.

Length, 34; maximum diameter, 9 mm.

Mayaguez Harbor, Porto Rico.

A strong and elegant species.

Drillia ponciana, n. sp. Plate 57, fig. 19.

Shell small, solid, of a warm reddish brown, with the prominences of the sculpture paler, with one and a half smooth nepionic and six and a half subsequent sculptured whorls; a narrow, deep anal fasciole and reticulated sculpture of subequal axial and spiral threads minutely nodulous at the intersections; the spirals on the upper whorls increase from one to three between the sutures, and the posterior spiral is at first very marked; aperture as figured; pillar and throat deep reddish brown, outer lip heavy; notch short, subcircular.

Length, 6.5; maximum diameter, 2.5 mm.

Playa de Ponce, Porto Rico.

A small, solid, and very elegant shell, belonging in the group to which *D. nigrescens* Gray is referred, but different from anything in the National collection.

Drillia melonesiana, n. sp. Plate 57, fig. 20.

Shell small, solid, strong, spindle-shaped, with one or two smooth nepionic and eight strongly sculptured subsequent whorls; type of an ashy brown (possibly in some cases nearly or quite black) with the sculptural prominences white; notch short, subcircular, leaving a narrow, strongly excavated fasciole separated from the suture behind it by a line of half-moon-shaped nodules, though the fasciole is so narrow and deep that at first sight it would be taken for the suture; sculpture essentially as figured, with fine interstitial spirals reticulated by the incremental lines; aperture narrow, not lirate, pillar and throat brownish.

Length, 10; maximum diameter, 4 mm.

Off Point Melones, Porto Rico, at station 144.

A solid, richly sculptured little shell, of which the brown color may be due to fading, though the type is quite fresh-looking. It does not appear to belong to the *D. albinodata* series, but has more sharply cut sculpture.

Drillia interpleura, n. sp. Plate 57, fig. 21.

Shell small, solid, strongly sculptured, with two smooth nepionic and six subsequent whorls; region of the canal and prominences on the ribs whitish, the rest of the shell yellowish brown with a dark reddish brown flammule in the valley between each pair of ribs; sculpture essentially as figured, ribs seven or eight, the outer lip much thickened behind and thin at the outer edge, lirate within; pillar and throat yellowish.

Length, 10; maximum diameter. 4 mm.

Mayaguez Harbor, Porto Rico.

This very pretty little species has a general resemblance to several others, but when a close comparison was made seemed to be not identical with any recorded from the region or contained in the National Museum.

Drillia albinodata Reeve.

Pleurotoma albinodata Reeve, Conch. Icon., I, pl. XXXVIII, fig. 352, 1846.

Shell solid, with about ten whorls; suture impressed but not deep, with a slight revolving ridge below it, followed by a wide, shallow groove; below this is a somewhat raised nodulous shoulder, the nodules are extended toward the base as faint ribs. Below the shoulder there are three or four feeble revolving ridges which are swollen into nodules where they cross the longitudinal ribs. Besides this the whole surface of the shell is sculptured with exceedingly fine, revolving threads. Varix heavy; aperture short; sinus deep, rounded, nearly closed in front, and above it the upper edge of the last whorl is raised on the penultimate whorl. On the shoulder there is a white band, and there are two white bands on the base of the shell; the rest of it is a dark brown.

Length of specimen from Porto Rico, 12; diameter, 5 mm.

One shell, Playa de Ponce reef.

Drillia albocincta C. B. Adams.

Pleurotoma albocincta C. B. Adams, Proc. Bost. Soc. Nat. Hist. II, p. 3, 1845; Tryon, Man., VI, p. 196, pl. XIV, fig. 6 (as *Drillia zebra* Lam.), 1884.

Shell small, solid, with about eight whorls, with a low shoulder bearing on it a series of tubercles which are sometimes elliptical, and at others form two nearly perfect series. Under the suture there is a low, slightly tuberculous ridge, and between this and the shoulder a wide, shallow groove. Below the shoulder there are several revolving nodulous threads; aperture short, truncate below. The general surface is covered with very fine, revolving threads and is dark brown; the nodules are white.

Length, 10; diameter, 4.5 mm.

Arroyo; Puerto Real; Mayaguez Harbor, Porto Rico.

The two foregoing species belong to a group of closely related and variable forms. Tryon throws a number of them into the synonymy of *Drillia zebra* Lamarck, and it is possible that both the above may be merely forms of that species.

Drillia solida C. B. Adams.

Pleurotoma solida C. B. Adams, Contr. to Conch., p. 61, 1850.
Drillia fuscescens Tryon (in part), Man., VI, p. 193, pl. XIV, fig. 98, 1884.

Shell with eight or nine whorls, with rather strong, oblique, slightly flexuous ribs, which end at the shoulder; above the shoulder is a wide, concave furrow, and between the furrow and the suture is a sharp ridge. Between the ribs are revolving threads which are stronger on the base; aperture short, narrowed below. Color dark brown, the spaces between the ribs on the shoulder lighter.

Length, 10; diameter, 4 mm.

Island of Vieques, one shell, slightly broken.

Drillia thea Dall.

Drillia thea Dall, Proc. U. S. Nat. Mus., VI, p. 328, pl. X, fig. 5, 1883.

Shell with eight whorls, the first one and a half smooth, the others with delicate growth lines, and having about seven or eight strong, slightly curved ribs; these ribs are nearly continuous from the apical whorls to the base of the shell, being only slightly cut by the narrow suture, and becoming a little fainter at the faintly impressed fasciole; varix distinct, canal somewhat drawn out. Color generally that of wet tea leaves.

Length, 15; diameter, 4.5 mm.

Aguadilla; Mayaguez, Porto Rico; one dead and broken shell from each locality.

? **Drillia æpynota** Dall.

Drillia æpynota Dall, Blake Report, II, p. 96, pl. XXXVI, fig. 10, 1889.

Two young, badly worn shells were obtained in Mayaguez, Porto Rico, which may be this.

Drillia lissotropis Dall.

Pleurotoma (*Mangilia*) *lissotropis* Dall, Bull. Mus. Comp. Zool., IX, p. 58, 1881.
Drillia lissotropis Dall, Blake Report, II, p. 91, pl. XI, figs. 3, 4, 1889.

Shell small, with about eight whorls which are slightly convex, and having ten to twelve nearly straight, strong, longitudinal ribs; spaces between the ribs either smooth or delicately spirally striate;

the ribs extend well down over the body whorl, where they fade out; the rather long base is strongly, spirally lirate; varix high; columella nearly straight. Color of the shell white, pink, or purplish.

Length of largest specimen, 8; diameter, 3 mm.

Mayaguez, Porto Rico.

Genus BORSONIA Bellardi.

Subgenus CORDIERIA Rouault.

? **Borsonia rouaulti** Dall.

Borsonia (*Cordieria*) *rouaulti* Dall, Blake Report, II, p. 98, pl. XXXVI, fig. 11, 1889.

Three young, worn specimens, which were obtained at Mayaguez, may be referable to this species, but they are not in condition to be identified with certainty.

Genus MANGILIA (Leach) Risso, 1826.

Shell fusiform, imperforate, terminated below in a rather short canal; aperture oval-elongate; lip more or less notched above; no operculum.

Subgenus CYTHARA Schumacher, 1817.

Shell longitudinally costate; external surface usually finely granulostriate; outer lip denticulated within; inner lip striate; aperture narrow, elongate.

Mangilia asarca, n. sp. Plate 57, fig. 14.

Shell minute, white, or with faint yellowish flammules, with six brilliantly polished, slender whorls; nepionic shell small, depressed, smooth, subsequent whorls with about ten axial riblets, slightly flexuous near the suture and becoming obsolete anteriorly, the peripheral part of the last whorl smooth or destitute of spiral sculpture, which on the base and canal is well developed and consists of fine striation; notch short, subcircular, leaving no fasciole; outer lip slightly thickened, not lirate within.

Length, 4.5; maximum diameter, 1.5 mm.

Mayaguez, Porto Rico.

This is a small but elegant species, which differs from the majority of its congeners in the absence of the fine, frosty granulation of the surface which is so characteristic of many of them, and in the somewhat obscure development of the axial ribs.

Mangilia balteata Reeve.

Mangilia balteata Reeve, Conch. Icon., III, pl. VII, fig. 57, 1846.

Spire elevated, whorls but slightly rounded, having about six strong, straight, longitudinal ribs, which are nearly continuous and are only partly interrupted by the suture; surface generally sculptured with faint, revolving threads; aperture two-fifths of the length of the shell; canal not lengthened. Color generally whitish, encircled with a median chestnut zone, which is sometimes wanting.

Length, 12; diameter, 4 mm.

Three fragments were obtained in Mayaguez Harbor.

Mangilia densestriata C. B. Adams.

Mangilia densestriata C. B. Adams, Contr. to Conch., 1850, p. 65.

Shell fusiform, with seven whorls, which are shouldered above, and have from eight to twelve strong, nearly straight ribs, the last whorl having but eight ribs; suture deep; surface everywhere covered with fine but sharp, high, revolving threads, which are not interrupted on the ribs; notch in the outer lip shallow; base slightly attenuated; canal wide. Color white; in one specimen there are three faint, broken, revolving bands on the body whorl, which show most distinctly on the ribs; in another there are only a few scarcely perceptible dots on the ribs in two rows.

Length, 6; diameter, 2.25 mm.

Mayaguez Harbor, Porto Rico, one perfect and one broken shell. This agrees very well with the description by C. B. Adams of his *Mangilia densiclathrata*. His specimen or specimens were white.

Mangilia psila Bush.

Mangilia psila Bush, Trans. Conn. Acad. Sci., VI, p. 455, pl. XLV, fig. 2, 1885.

Shell elongated, with about nine whorls, each having six straight ribs which are barely interrupted by the suture; the ribs have a slight nodule at the middle of the whorl, and sometimes there is a single pinched-up, revolving ridge on this part of the shell; growth lines delicate; surface covered with very nearly obsolete revolving threads; notch in the outer lip feeble; base slightly attenuated. Color whitish; some specimens having a narrow, median, brownish, revolving band.

Length, 6; diameter, 2 mm.

Mayaguez, Porto Rico, five broken and worn shells.

Mangilia biconica C. B. Adams.

Mangilia biconica C. B. Adams, Contr. to Conch., 1850, p. 65.

Shell small, biconic, with about six longitudinally ribbed, subangular whorls; ribs nearly straight, nine or ten on the last whorl and forming a slight shoulder above, the spaces between the ribs filled with fine, spiral sculpture; aperture rather wide above, narrowed below into a short canal.

Length, 5; diameter, 2.5 mm.

Seven worn and broken specimens were obtained at Mayaguez, Porto Rico. They are in such bad condition that it is impossible to say whether they belong to the typical form, which is banded on the periphery and which sometimes has a secondary band below, or to the variety *alta*, which is entirely white. A specimen from San Juan has some indication of brown banding on the last whorl.

Subgenus DAPHNELLA Hinds, 1844.

Shell thin, fusiform, body whorl elongated; surface cancellated; lip simple, not varicose.

Mangilia morra Dall.

Pleurotoma (*Drillia*) *morra* Dall, Bull. Mus. Comp. Zool., IX, p. 69, 1881.
Daphnella morra Dall, Blake Rep., II, p. 105, pl. XII, fig. 1, 1889.

Shell short, fusiform, having six rounded whorls, with a deep suture; sculpture consisting of numerous slightly curved longitudinal riblets and many revolving threads, which cover the entire surface with a nearly evenly cancellated pattern; notch in the outer lip deep; base somewhat suddenly drawn in from the rather swollen body whorl; canal moderate, nearly straight. Color brown.

Length, 3; diameter, 1.25 mm.

A single, somewhat worn specimen was obtained from Mayaguez Harbor, Porto Rico.

Mangilia elata Dall. Plate 54, fig. 17.

? *Daphnella elata* Dall, Blake Report, II, p. 105, 1889.

Five badly broken, worn shells were received from Mayaguez, which are probably this species.

Subgenus GLYPHOSTOMA Gabb, 1872.

Shell fusiform; outer lip thickened into a varix, slightly dentate within, the notch deep and rounded; surface covered with longitudinal ribs crossed by strong revolving striæ, and marked besides with an exceedingly delicate pattern of decussated sculpture.

Mangilia aguadillana, n. sp. Plate 57, fig. 22.

Shell small, slender, solid, nine-whorled, of which the first three are nepionic, smooth and polished, the subsequent elegantly axially ribbed, with two to four primary spiral threads and fine interstitial spiral striation, essentially as figured. Shell white with a superficial brownish tinge on the larger whorls, apex and interior of outer lip of a delicate lilac; outer lip strongly thickened, inner lip and aperture smooth or destitute of the denticulations usually found in this genus.

Length, 14; maximum diameter, 4 mm. A variety *minor* is exactly similar in sculpture, but of a pale-straw color, and is 8.5 mm. long and 3 mm. in maximum diameter.

Aguadilla, Porto Rico; the variety from Mayaguez Harbor, station 6062.

If the absence of the oral processes is not due to immaturity, this form would better be referred to *Clathurella*.

Subgenus MANGILIA s. s.

Mangilia luctuosa d'Orbigny.

Pleurotoma luctuosa d'Orbigny, Moll. Cubana, II, p. 255, pl. XXIII, figs. 29–31, 1845.

San Juan, Porto Rico (Gundlach); Cuba; Guadeloupe. This may not be a *Mangilia*.

Mangilia quadrata Reeve.

Pleurotoma quadrata Reeve, P. Z. S., 1845, p. 114; Conch. Icon., I, pl. XXVIII, fig. 253, 1845.

Shell short, fusiform, biangulate on the body whorl; surface covered with strong longitudinal ribs, there being about eight on the body whorl. The shell is cancellated with a set of sharp, revolving threads, that on the shoulder above being particularly strong; there are three of these threads on the body whorl that are stronger than the others, the lower one marking the lower angulation; those of the base becoming fainter; notch in the outer lip shallow; canal rather short.

Length, 4.5; diameter, nearly 2 mm.

Surface whitish, clouded with brown.

Mayaguez, Porto Rico, many worn shells; off Boca Prieta, one dead shell.

Two specimens of the variety *quadrata* were also obtained at Mayaguez.

Mangilia lavalleana d'Orbigny.

Pleurotoma lavalleana d'Orbigny, Moll. Cubana, II, p. 174, pl. XXIV, figs. 7, 9, 1845.

A single specimen was obtained at Mayaguez that may be this species, but it is in bad condition and can not be determined with certainty.

Mangilia sp.

A single young, imperfect shell, something like *M. rubella* Kurtz & Stimpson, was obtained at Mayaguez.

Mangilia melanitica Dall. Plate 58, fig. 10.

Mangilia melanitica (Dall, MS.) Bush, Trans. Conn. Acad. Sci., VI, p. 459, pl. XIV, figs. 3, 3*a*, 1885.

Shell with a rather slender spire and short base, with nine whorls, the first two rounded and smooth, the rest covered with revolving liræ, of which the median one is strongest, making the shell somewhat angular in the middle of the whorls and shouldered on the last whorl; the four lower whorls have faint, slightly oblique longitudinal ribs; aperture much wider above than below; outer lip slightly thickened; the notch large, deep, and rounded, the lip surrounding it inflated into a raised rim. Color whitish, stained with brown, the aperture and base darker.

Length, 4.5; diameter, 1.5 mm.

Mayaguez, Porto Rico, many worn shells.

Mangilia trilineata C. B. Adams.

Pleurotoma trilineata C. B. Adams, Contr. to Conch., p. 55, 1845; Tryon, Man., VI, p. 247, pl. XXI, fig. 31, 1884.

Quebradillas, Porto Rico (Gundlach).

Family CANCELLARIIDÆ.

Genus CANCELLARIA Lamarck, 1822.

Shell oval, generally cancellated; last whorl ventricose, with a short canal and strong siphonal fasciole; columella with several oblique plications.

Type, *C. reticulata* Linnæus.

Subgenus CANCELLARIA s. s.

Cancellaria reticulata Linnæus.

Voluta reticulata Linnæus, Syst. Nat., ed. XII, p. 1190, 1767.
Cancellaria reticulata Tryon, Man. Conch., VII, p. 69, pl. II, figs. 25, 26, 1885.

Porto Rico (Gundlach); Florida.

Subgenus TRIGONOSTOMA Blainville, 1827.

Shell generally umbilicated, whorls wider and usually shouldered above; aperture trigonal; outer lip not contracted in front; canal obsolete. Type, *Murex scala* Gmelin.

Cancellaria agassizii Dall.

Trigonostoma agassizii Dall, Blake Report, II, p. 130, pl. XXXV, fig. 4, 1889.

Shell with five whorls, the first rounded and smooth, the second gradually becoming cancellated, the subsequent whorls somewhat roundly shouldered above, having very strong, slightly flexuous ribs, ten on the last whorl, and about sixteen strong, revolving liræ, which are slightly nodulous on the ridges; in addition to this there are very fine, longitudinal threads all over the surface; varix on the outer lip but little stronger than the ribs; aperture ovate; outer lip strongly ridged within; canal short, open; columella scarcely callous, the threads running over it into the aperture, and having three plaits; umbilicus nearly closed by the reflected columella. Color reddish brown or brownish orange.

Length, 8; diameter, 5 mm.

A single slightly worn and bleached shell was obtained at Mayaguez, Porto Rico. The species extends north to Cape Hatteras, North Carolina.

Superfamily RHACHIGLOSSA.

Family OLIVIDÆ.

Genus OLIVA Bruguières, 1789.

Shell oblong, subcylindrical, brilliantly polished; spire rather short; last whorl covering the greater part of the others; aperture elongated, slightly dilated in front; columella vertical, callous, more or less plicate; lip simple, thick, not reflected or toothed within; a sinus above is continued as a canal along the suture; notch at the base short, but well marked. No operculum.

?Oliva litterata Lamarck.

Oliva litterata Lamarck, Ann. du Mus., XVI, p. 315, 1809.
Oliva literata Reeve, Conch. Icon., VI, pl. XI, fig. 18, 1850.

This species was found at San Juan, Porto Rico, according to Gundlach. It is quite probable that the specimens he so named were the nearly allied form described in this paper as *O. caribæensis*.

Oliva reticularis Lamarck.

Oliva reticularis Lamarck, Ann. du Mus., XVI, p. 314, 1809.
Oliva reticularis Tryon, Man., V, p. 83, pl. XXX, figs. 90–95, 1883.

Shell rather slender, slightly swollen at the middle; spire somewhat elevated; ridges on the columella numerous and strong. Ground color whitish overlaid with a faint pattern of purplish brown reticulations, which sometimes shows the white as triangular spots. Frequently there are two darker bands near center of outer whorl, and under the suture are clusters of brownish, subvertical lines.

Length, 35 to 50; diameter, 15 to 20 mm.

Aguadilla; Mayaguez, Guanica, Porto Rico, many worn specimens; St. Thomas, one shell; Vieques, one fine specimen taken alive. A dark variety was found at Fajardo, Porto Rico.

Oliva caribæensis, n. s. Plate 56, fig. 9.

Shell rather short and stout, its greatest diameter being near the shoulder; spire low, the suture being deeply channeled; outer lip heavy; columella having a strong white callus extending up for two-thirds of the length of the aperture, where it thins out; columellar plications numerous and distinct but not strong. The ground color is ashy yellow, becoming darker below, overlaid with a close faint reticulation of reddish brown. There are two faint bands of darker reticulations on the outside whorl and splashes and lines of this dark color under the suture. The interior is purplish; the columella is a little lighter colored.

Length, 32; diameter, 15 mm.

Mayaguez Harbor, Porto Rico.

A rather dull and inconspicuous species, the most cylindrical of the Antillean forms and perhaps nearest to *O. litterata* Lamarck.

Genus OLIVELLA Swainson, 1835.

Shell small, polished, oblong; spire acuminate; internal shell absorbed; suture canaliculate; aperture wider below; outer lip but slightly thickened; columella plicate below, with a stronger plication at or near its base. Operculum generally present, oval, elongated, obtuse at its extremities, nucleus subapical.

Olivella jaspidea Gmelin.

Voluta jaspidea Gmelin, Syst. Nat., p. 3442, 1792.
Oliva jaspidea Reeve, Conch. Icon., VI, pl. XXII, fig. 58, 1850.

Shell solid; spire rather elongated; whorls about five; base of the aperture moderately expanded; columella plicate throughout or nearly so, with a slightly thickened wide ridge at or near its base. Color generally ashy or whitish, overlaid with a slate-colored or purplish pattern. This pattern may be indistinct reticulations or zigzags or irregular dots and blotches, and it often shows the white ground in triangular patches. There is almost always a row of dark lines or spots below the suture; there are often faint bands on the body whorl, and sometimes dark markings on the base.

Length, 18; diameter, 8 mm.

Hucares; Aguadilla, Porto Rico; Caballo Blanco Reef, Vieques; Culebra Island.

It is almost impossible to write any description which will fully and accurately cover this abundant and variable species. Some specimens of it are quite slender and not very solid; others are shorter and heavier, and the color pattern varies from white with faint markings to very dark.

Olivella esther Duclos.

Olivella esther Duclos, Monog. Gen. Oliva, pl. III, figs. 7, 8, 1835.

Shell heavy, short, with a rather low spire whose sides are nearly straight; columella with a strong, high, narrow ridge near its base, and a heavy callus above, which extends to the upper part of the penultimate whorl; yellowish white overlaid with a pattern of brown markings, showing tentlike white spots, with darker, broken markings below the suture and near the base. Just at the base there is a distinct, solid band of brown.

Length, 16; diameter, 7 mm.

A large number of worn shells were found at Mayaguez, Porto Rico.

Olivella mutica Say.

Oliva mutica Say, Journ. Acad. Nat. Sci. Phila., II, p. 228, 1822.
Olivella mutica Tryon, Man., V, pl. XIV, figs. 43-55, 1883.

Shell rather small, heavy, with usually a rather short spire, though sometimes it is lengthened; columella feebly plicate, having a fold near its base, strongly callous above. Color ashy white, gray, or bluish, often more or less marked with brownish spots or zigzag lines. In some cases portions of the aperture are very dark.

Length, 7; diameter, 3.5 mm.

A single specimen was obtained in Mayaguez Harbor.

Olivella rotunda Dall. Plate 56, fig. 11.

Olivella jaspidea var. *rotunda* Dall, Blake Report, II, p. 134, 1889.

Shell inflated with a short, rounded but pointed spire; suture canaliculate, deep and narrow; aperture but slightly spread below; columellar area with a strong raised callus, which runs to the top of the penultimate whorl and continues around the upper whorls as a thickened glazing; the columellar callus is longitudinally sculptured with exceedingly delicate, microscopic line, and is swollen just below its upper end. The columellar plications are numerous and strong, and between the upper and lower set there is an indentation of the columella within.

Color pale ashy yellowish, with faint, irregular, broken, zigzag markings of a darker tint, and there is a yellowish band near the base having a darker streak below it.

Length, 15 to 23; diameter, 7 to 11 mm.

Mayaguez Harbor; Aguadilla, Porto Rico; a number of fine specimens.

The series of fine shells collected by the *Fish Hawk* expedition seems to show that this is a valid species of *Olivella*, as good as the average species in this difficult genus. Its form is something like that of specimens of *O. biplicata* of the West Coast, but the spire is not so elevated as in that species, nor is its base so expanded.

Olivella oryza Lamarck.

Oliva oryza Lamarck, An. sans Vert., VII, p. 439, 1822; Chemnitz, Conch. Cab., II, 1771, pl. L, fig. 548.

Shell small; spire rather short; whorls somewhat rounded; obtuse; columella without teeth, or with but faint indications of them, twisted and ending in a distinct curved plait; columellar area narrowly callous. Color white or milky throughout.

Length, 4; diameter, 1.5 mm.

Mayaguez, Porto Rico, many slightly worn shells.

Lamarck's description is too brief to properly characterize this species, and the figure he refers to in the Conchylien Cabinet is a dorsal view and rather poor.

Olivella nivea Gmelin

Voluta nivea Gmelin, Syst. Nat., p. 3442, 1792.
Olivella nivea Tryon, Man., v, p. 67, pl. xv, figs. 74-88, 1883.

San Juan, Porto Rico (Gundlach); Florida; West Indies.

Olivella verreauxi Duclos.

Oliva verreauxi Duclos, Rev. Crit., p. 97, pl. III, figs. 86 *a*, *b*, 1857.

According to Gundlach this form is found at Aguadilla and Quebradillas, Porto Rico.

Family MARGINELLIDÆ.

Genus MARGINELLA Lamarck, 1801.

Shell imperforate, ovoid conical or subcylindrical, porcellanous, smooth and shining, sometimes having longitudinal ridges; spire rather short or often sunken; aperture long; outer lip thickened and sometimes toothed; columella with three or four plaits.

Marginella apicina Menke.

Marginella apicina Menke, Syn. Meth. Moll., p. 87, 1828.
Marginella conoidalis Reeve, Conch. Icon., XV, pl. XVIII, fig. 87.

Shell solid, conoidal; spire low, plane, the suture merely marked by a line; outer lip having a heavy, distinctly marked varix, smooth within; base rounded; columella with four strong, nearly equal plaits, the two lower a very little nearer together than the others; parietal wall callous above.

Color white, amber, or sometimes pale ashy reddish, the nucleus generally reddish and always translucent; there are usually three or four brown blotches just at the back of the varix, one of these on the spire and one at the base of the shell, but they are sometimes partly or wholly wanting.

Length, 12; diameter, 7.5 mm.

Three fine, small specimens were taken on the beach at Mayaguez.

A beautiful, common, and widely distributed species, quite variable in size and coloring. It is often faintly banded.

Marginella hematita Kiener.

Marginella hematita Kiener, Coq. Vivantes, genus *Marginella*, p. 11, pl. VII, fig. 31, 1841.

Shell conoidal, solid, with a rather elevated spire; whorls five, slightly rounded; outer lip heavily varicose, advanced in the middle, with about fifteen teeth inside; base rounded; columella with four very prominent strong, even plaits, which are evenly spaced; columellar area not calloused; surface smooth, sometimes slightly pustulous or pitted. Color purplish or deep red.

Length, 9; diameter, 5.5 mm.

Aguadilla, Porto Rico, one worn shell.

This is a beautiful species when fresh, and is often colored very brilliant deep red.

Marginella striata Sowerby.

Marginella striata Sowerby, Thes. Conch., I, pl. LXXV, figs. 81, 82, 1846.

Shell volutiform; spire moderately produced, the whorls slightly rounded; spire and body whorl covered with straight, longitudinal ribs; outer lip thickened into a distinct varix, strongly crenated within; columella with four strong, equal plaits. Color whitish.

Length, 3; diameter, 1.5 mm.

Mayaguez Harbor, Porto Rico, one worn, broken shell.

Marginella evadne, n. sp. Plate 57, fig. 10.

Shell minute, white, solid, polished; form and proportions essentially as figured; the whorls sculptured by fine, even, axial, close-set striæ, obsolete anteriorly; the aperture narrow; the pillar lip with six or seven close-set plaits, enlarging anteriorly, the most anterior being considerably the largest; outer lip not marginate; in fully adult specimens minutely crenulate within.

Length, 2.5; maximum diameter, 1.5 mm.

Mayaguez Harbor, Porto Rico.

This species needs to be well magnified and closely scrutinized to reveal its peculiarities. When worn the striation is often destroyed. The specimen figured had not acquired the crenulation of the outer lip. There is an allied species with short rather prominent small riblets on the shoulder of the whorls which is found in the West Indies, but it can not be confounded with the present one if the characters be attended to.

Section VOLVARINA Hinds.

Marginella torticula Dall.

Marginella torticula Dall., Bull. Mus. Comp. Zool., IX, p. 73, 1881.
Marginella torticula Dall., Blake Report, II, p. 141, pl. XIX, fig. 7, 1889.

Shell slender, glossy, grayish waxen white, with about five whorls; spire roundly pointed, glazed so as to nearly cover the sutures, last whorl appressed on the shoulder; axis laterally curved so that the spire and base turn to the right; aperture long, narrow; columella with four very oblique plaits; outer lip simple, not reflected, slightly thickened and produced posteriorly; canal wide.

Length, 11.5; diameter, 3.75 mm.

Mayaguez Harbor, one young and one badly broken adult shell.

Marginella avena Valenciennes.

Marginella avena Valenciennes in Kiener, Coq. Viv., *Marginella*, p. 17, pl. VI, fig. 24, 1841.

Shell elongated, with an elevated, somewhat glazed spire; aperture long and narrowed above; outer lip thickened and slightly varicose, somewhat incurved at middle; columella curved, armed with four strong plaits, lower ones a little the heaviest. Color milky white or subtranslucent, generally having three wide, faint bands of yellowish brown on body whorl that are usually more or less broken.

Length, 12; diameter, 5 mm.

Aguadilla, Porto Rico, three worn shells; Ensenada Honda, Culebra, two shells.

Marginella albolineata d'Orbigny.

Marginella albolineata d'Orbigny, Moll. Cubana, II, p. 99, pl. XX, figs. 27-29, 1845.

Shell elongated, rounded and rather inflated above, somewhat narrowed below; spire low, bluntly pointed, glazed; aperture long, narrow above, wider below; outer lip incurved a little at the middle, slightly thickened and varicose; columella curved below, with four elevated plaits, the lower a little stronger. Color yellowish white or amber, with from three to five more or less developed brownish bands, which show more distinctly on the varix.

Length, 9; diameter, 4 mm.

Ensenada Honda, Culebra, one shell.

Marginella lactea Kiener.

Marginella lactea Kiener, Coq. Viv., *Marginella*, p. 42, pl. XIII, fig. 3, 1841.

Shell rather small, with a moderately developed glazed spire; outer lip thickened a little, scarcely varicose, incurved in the middle; columella nearly straight, with four strong, nearly even plaits. Color milky white throughout.

Length, 7; diameter, 3 mm.

Mayaguez, Porto Rico, one shell; Ensenada Honda, Culebra, six specimens. Close to the last, but having a rather higher spire and differing in color pattern.

Marginella fusca Sowerby.

Marginella fusca Sowerby, P. Z. S., 1846, p. 95.
Marginella fusca Sowerby, Conch. Icon., XV, pl. XVII, fig. 82, 1865.

Shell elongated, with rather elevated, glazed, pointed spire; outer lip with a delicate, narrow varix ascending the spire, decidedly incurved at the middle; columella nearly straight, with four oblique plaits, the lower the strongest; parietal callus widened below. Color smoky brownish, with two or more wide, faint, darker bands.

Length, 8; diameter, 3.5 mm.

Arroyo, Porto Rico, one specimen.

Marginella subtriplicata d'Orbigny.

Marginella subtriplicata d'Orbigny, Moll. Cubana, II, p. 99, pl. XX, figs. 30–32, 1845.

Shell elongated, subcylindrical; spire glazed, of moderate height; outer lip scarcely thickened, much advanced at the middle, where it is slightly inflected; aperture narrow, a very little wider below; columella straight, with three moderate, equal plaits, and sometimes a faint indication of a fourth one above; parietal wall with a narrow callus. Color yellowish white.

Length, 10; diameter, 4 mm.

Ensenada Honda, Culebra, one adult and two young specimens.

Marginella pallida Donovan.

Bulla pallida Donovan, Brit. Shells, pl. LXVI, fig. 527, 1800.

Shell cylindrical, thin but strong, with a low, bluntly pointed spire; outer lips scarcely thickened but rounded on its edge, very slightly incurved in the middle; columella rather sharply curved, with four moderate, very oblique plaits, the two lower a little nearer together and elevated on a twisted ridge that forms the termination of the columella. Color whitish or straw color.

Length, 15; diameter, 7 mm.

Mayaguez, Porto Rico, one shell; Caballo Blanco Reef, Vieques, one young specimen.

Subgenus PERSICULA Schumacher, 1817.

Shell bulliform, with spire depressed or sunken, generally marked with broken bands of color; outer lip denticulated; inner lip callous above, having four plaits below and smaller ones above them.

Marginella catenata Montagu.

Marginella catenata Montagu, Test. Brit., p. 236, pl. VI, fig. 2, 1803.

Shell obtusely ovate; spire concealed, covered by the last whorl, which incloses it with a plicate edge, and this is sometimes overlaid with callus; aperture narrow, curved, slightly wider below; outer lip having fine plications within; columella heavily callous, with four strong plaits below and a few fainter ones above; base slightly notched. Color whitish, with chain-like revolving bands of milk-white and brownish markings.

Length, 3.5; diameter, 2.5 mm.

Mayaguez, Porto Rico, two badly worn shells. The specimens are in such condition that they can only be referred to this species with doubt.

Marginella catenata var. **pulcherrima** Gaskoin.

Marginella pulcherrima Gaskoin, P. Z. S., 1849, p. 21.
Marginella pulcherrima Tryon, Man., V, p. 39, pl. XI, fig. 30, 1883.

Has the form of *M. catenata*, but the ground color is pale brown, with revolving rows of white spots. The callous nucleus is painted with a brown, many-pointed star, and there are two wide, whitish bands on the body whorl bearing vertical brown lines. At each edge of these light bands is a row of dark, minute spots, and there is a little dark color on the base.

Mayaguez, Porto Rico, one beautiful shell.

Marginella interrupte-lineata Muhlfeld.

Marginella interrupte-lineata Muhlfeld, Berl. Mag. Naturf. Fr., 1818, p. 6, figured.

Mayaguez, Porto Rico (Gundlach).

Subgenus VOLUTELLA Swainson.

Spire somewhat elevated, but wholly concealed by the last whorl; outer lip thickened and varicose; columella with three or four plaits.

Marginella ovuliformis d'Orbigny.

Marginella ovuliformis d'Orbigny, Moll. Cubana, II, p. 101, pl. XX, figs. 33–35, 1845.

Shell minute, glassy white, swollen above; outer lip heavy, developed into a well-marked varix which extends on to the spire and is feebly denticulated within; aperture narrow and of about even width throughout; columella with three plications.

Length, 1.75; diameter, 1 mm.

Mayaguez, three shells.

Family VOLUTIDÆ.

Genus VOLUTA (Linnæus, 1758) Lamarck, 1799.

Voluta musica Linnæus.

Voluta musica Linnæus, Syst. Nat., ed. x, p. 733, 1758; Reeve, Conch. Icon., vi, pl. viii, 1849.

San Juan, Porto Rico (Gundlach); West Indies.

Family TURBINELLIDÆ.

Genus TURBINELLA Lamarck, 1799.

Subgenus Vasum Link, 1807.

Turbinella muricata Born.

Voluta muricata Born, Mus. Vind., p. 233, 1780.
Turbinella muricata Reeve, Conch. Icon., iv, pl. vii, fig. 35, 1847.

Mayaguez, Porto Rico (Gundlach); West Indies; Florida Keys.

Family MITRIDÆ.

Genus MITRA Lamarck, 1799.

Shell solid, fusiform; spire elevated, pointed; aperture narrow, notched in front; outer lip not reflected, thickened and smooth within; columella transversely, somewhat obliquely plicate; no operculum.

Mitra barbadensis Gmelin

Voluta barbadensis Gmelin, Syst. Nat., p. 3455, 1792.
Mitra picta Reeve, Conch. Icon., ii, pl. xvi, fig. 123, 1844.

Shell with about eight nearly flat whorls, covered with somewhat distant, raised, revolving threads; besides this the surface is covered with a pattern of microscopic revolving and longitudinal liræ, making the spaces between the larger threads decussated; suture shallow, but well marked; aperture elongated, wider below; columella with four whitish plaits, the lower one quite faint. Color light brown, sometimes with longitudinal white bands, and often blotched with white.

Length, 35; diameter, 13 mm.

Guanica, Porto Rico; Caballo Blanco Reef, Vieques.

Mitra nodulosa Gmelin.

Voluta nodulosa Gmelin, Syst. Nat., p. 3445, 1792.
Mitra granulosa Reeve, Conch. Icon., ii, pl. ix, fig. 62, 1844.

Shell with about ten whorls, which are scarcely rounded but are narrowly shouldered above; suture distinct, impressed; surface sculptured by longitudinal ribs, which are cut by revolving furrows into coarse, rounded nodules, there being four of these furrows on the upper whorls and twelve on the body whorl; aperture scarcely widened below; basal notch deep; columella with four plaits, the upper strong, the lower faint. Color varying from pale to dark brown; the teeth whitish.

Length, 35; diameter, 13 mm.

Aguadilla, Porto Rico, one young shell.

Mitra hanleyi var. gemmata Sowerby.

Mitra gemmata Sowerby, Thes. Conch., sp. 334, fig. 649, 1874.

Shell somewhat biconic, with about seven whorls, there being a single row of strong, somewhat longitudinal nodules on the center of the whorls; above the nodules the shoulder is slightly concave; the surface is sculptured with faint, longitudinal riblets crossed by almost obsolete microscopic striæ; aperture rather short, slightly drawn out below; columella with three plaits.

General surface purplish black or very deep brown; the large nodules on center of whorls are white.

Length, 7; diameter, 3 mm.

Ensenada Honda, Culebra, two young shells.

A beautiful little form, probably a variety of *Mitra hanleyi* Dohrn (1862), not of Sowerby (1874).

Mitra straminea A. Adams.

Mitra straminea A. Adams, P. Z. S., p. 132, 1851.
Mitra straminea Tryon, Man., IV, p. 140, pl. XLI, fig. 188, 1882.

Shell small, slender, with about eight somewhat rounded whorls, which are sculptured by strong, sharp revolving ridges; there are four or five of these on the upper whorls and fourteen to sixteen on body whorl; between the revolving ridges the surface is sculptured with sharp, longitudinal threads; aperture elongated, scarcely wider below; columella three-plaited. Color yellowish white.

Length, 15; diameter, 5 mm.

Mayaguez, Porto Rico, three worn and broken young shells.

Mitra microzonias Lamarck.

Mitra microzonias Lamarck, An. sans Vert., VII, p. 320, 1822.
Mitra microzonias Tryon, Man., IV, p. 183, pl. LIV, figs. 568, 569, 1882.

San Juan, Porto Rico (Gundlach); West Indian region.

Genus MITROMORPHA A. Adams, 1865.

Shell small, somewhat elongate and biconic, with a globose nucleus; aperture scarcely or not at all notched behind; columella nearly straight, generally having faint vestiges of oblique plaits, which do not extend far into the shell; surface sculptured.

Mitromorpha biplicata Dall.

Mitromorpha biplicata Dall, Blake Report, II, p. 165, pl. XXXV, fig. 1, 1889.

Shell biconic, cancellated, yellowish or whitish, with brown flammules; nucleus glassy, of one and a half turns, other whorls five or six, slightly rounded; aperture not widened below; columella with two fairly strong plaits; outer lip lirate within.

Length, 7; diameter, 3 mm.

A fragment having a perfect aperture was found at Mayaguez.

Family FASCIOLARIIDÆ.

Genus FASCIOLARIA Lamarck, 1801.

Shell imperforate, fusiform, solid; spire rather elevated, sharp pointed; aperture oval-oblong, with a canal in front; outer lip simple, furnished with liræ internally; columella concave, having a few oblique plications at its base. Operculum oval, pointed at the summit; its nucleus apical.

Fasciolaria gigantea Kiener.

Fasciolaria gigantea Kiener, Coq. Viv., *Fasciolaria*, p. 5, pls. X, XI, 1840.

Shell very large, solid, fusiform, with about ten whorls; spire well elevated, pointed; growth lines strong and irregular; the surface is covered with a series of more or less strongly developed, rounded, revolving ribs, and between these there are fainter ones; near the center of the whorls there is a row of large nodules, which are somewhat distantly spaced and which fade out on the body whorl; aperture ovate-oblong, the outer lip more or less ridged within; canal long, open, and slightly recurved; columella incurved, furnished with three folds below. The surface is salmon or chamois colored, and is covered with a strong, reddish-brown epidermis, which cracks and peels off when the shell is dry. The aperture varies from dirty straw color to deep salmon or reddish. Animal deep red.

Length, 16 inches to 2 feet; diameter, 7 to 10 inches.

Mayaguez, Porto Rico, one very young shell.

This is one of the largest of the Gastropods, being excelled in size only by the *Megalatractus aruanus* of Australia. The species varies much in the development of the tubercles, in some cases being almost destitute of them, and in others they are very strong and scarcely diminish in size on the last whorl. It is abundant in the waters of the Southeastern States, and differs from the *F. princeps* of the Pacific coast by the smooth external surface of its operculum.

Fasciolaria tulipa Linnæus.

Murex tulipa Linnæus, Syst. Nat., ed. X, p. 754, 1758.
Fasciolaria tulipa Kiener, Coq. Viv., *Fasciolaria*, p. 2, pls. I, II, 1840.

Shell with about nine somewhat rounded whorls, with a deep, well-defined suture, with irregular, impressed growth lines and revolving sculpture. This sculpture may consist of rather sharp, close ridges of various sizes, separated by concave furrows, or the surface may be scarcely marked by narrow, widely spaced grooves; the sculpture is stronger just below the suture, where it always becomes slightly nodulous, and on the base of the shell; spire of moderate height; aperture elongate-oval, the outer lip lirate within and marked on its inner edge with dark lines, which are often elevated into slight ridges and end in toothlike projections; canal of moderate length, slightly reflexed, open; columella incurved, with two or three folds below. The color pattern is variable. It is sometimes ash colored, overlaid with irregular, dull-brown markings and blotches, which may be disposed in faint wide bands. In other specimens the ground is nearly white, with blotches and cloudings of pale chocolate, salmon, or reddish, the revolving furrows being marked with darker color.

Length, 150; diameter, 65 mm.

Guanica; Ponce Reefs; Hucares; San Juan; Fajardo; Boqueron Bay, Porto Rico; Southeastern States; West Indies; Mexico and Central America.

The specimens living in brackish water are more strongly sculptured, duller colored, and rougher than those found living on open beaches, and are probably worthy of a varietal name. The species is larger than the allied *F. distans*, with which it has been sometimes confounded, and is always somewhat sculptured below the suture, while *distans* is not. As in the case of the *Strombus pugilis*, the more southeastern the locality the more pale the salmon coloration which characterizes the shell.

Genus LATIRUS Montfort, 1810.

Shell turriculated or oval fusiform; aperture oval-oblong; outer lip lirate within; columella with two or three faint folds below. Operculum oval-elongated, unguiculate, arcuate, concave at the columellar border; nucleus apical.

Subgenus LEUCOZONIA Gray, 1847.

Shell oval-fusiform, carinated, spire moderate, canal rather short; columella subflexuous.

Latirus cinguliferus Lamarck.

Turbinella cingulifera Lamarck, An. sans Vert., VII, p. 107, 1822.
Turbinella cingulifera Reeve, Conch. Icon, IV, pl. III, fig. 17, 1847.

Shell solid, with a moderately developed spire and having about eight whorls. The form and sculpture of the whorls vary remarkably. In some cases there is a revolving row of strong tubercles on the middle of the whorls, which forms a well-marked shoulder on the body whorl; in other cases the shell is absolutely destitute of nodules and the whorls are slightly rounded, and there is every possible variation between these extremes. The growth lines are strong and irregular, and the surface is covered with faint, revolving threads, so that it is more or less reticulated. The aperture is elliptical; the outer lip is generally lirate within, though sometimes it is nearly smooth. Above the base there is usually a sort of revolving ridge which ends in a small tooth or projection on the outer lip. The canal is rather short and recurved; the columella bears about four faint plaits, and the shell is often falsely umbilicate at its base. Color light brown to nearly black. There is generally a narrow, white band on the ridge just above the base.

Length, 55; diameter, 30 mm.

Guanica; Ponce reefs; Playa de Ponce; Cabo Rojo light, Porto Rico; Ensenada Honda, Culebra; West Indian region generally.

Latirus ocellatus Gmelin.

Buccinum ocellatum Gmelin, Syst. Nat., p. 3488, 1792.
Turbinella ocellata Reeve, Conch. Icon., IV, pl. VIII, fig. 38, 1847.

Shell solid, short, fusiform, with a row of nodules on the middle of the whorls, which becomes a strong ridge on the shoulder of the body whorl. There is a small, or secondary, row of nodules in the concave space above the shoulder. The surface of the shell is covered with small revolving ridges, and between these there are fine raised threads, and these are crossed by the distinctly marked growth lines, making the surface reticulate. Outer lip lirate within; canal short; columella with three folds. Color dark brown or bluish, the nodules white, and there are often broken white bands on the body whorl; aperture bluish white, with a dark-spotted border.

Length, 27; diameter, 18 mm.

Caballo Blanco, Vieques, two specimens; Puerto Real, Porto Rico, one shell; West Indian region generally.

Subgenus LATIRUS s. s.

Shell fusiform, turriculated, subumbilicated; spire produced; whorls nodulous.

Latirus brevicaudatus Reeve.

Turbinella brevicaudata Reeve, Conch. Icon., IV, pl. X, fig. 50, 1847.

Shell with about ten somewhat rounded whorls; spire elevated; whorls with about eight strong, rounded, nodulous, longitudinal ribs; surface covered with numerous, sharp, revolving ridges, and in the interstices of these there are smaller revolving ridges and liræ; aperture round-elliptic, the outer lip lirate within; canal rather short, recurved; columella with three or four plaits. Color reddish brown; revolving ridges darker.

Length, 40; diameter, 18 mm.

Off Point Melones, Porto Rico, one young shell.

Latirus infundibulum Gmelin.

Murex infundibulum Gmelin, Syst. Nat., p. 3554, 1792.
Turbinella infundibulum Reeve, Conch. Icon., IV, pl. I, fig. 3, 1847.

Shell elongate-fusiform, with about eleven whorls; spire elevated; whorls somewhat rounded, sculptured, with six or seven strong, nodulous, rounded, longitudinal ridges. On the upper whorls there are four or five strong, revolving ridges, and rarely a revolving thread in the interstices. Aperture long, ovate; outer lip strongly lirate within; parietal wall heavily callous, the callus sometimes being raised into a sharp lip; columellar plaits four; canal long, narrow. At the base of the shell there is a false umbilicus. Color reddish brown, the revolving ridges darker.

Length, 65; diameter, 23 mm.

Mayaguez Harbor; Porto Rico; off Vieques.

Family BUCCINIDÆ.

Genus PISANIA Bivona, 1852.

Shell oblong, smooth or spirally striated; spire prominent; outer lip thickened and crenated within; canal short; operculum ovate, nucleus apical.

Pisania pusio Linnæus.

Murex pusio Linn., Syst. Nat., ed. X, p. 754, 1758.
Buccinum pusio Reeve, Conch. Icon., III, pl. VI, fig. 43, 1846.

Shell somewhat elongated, having about ten or eleven slightly convex whorls; growth lines strong and almost riblike on the upper whorls, the first one and one-half being nearly smooth, the next four or five nodulous, and the next one and a half reticulated. Below this the sculpture fades out until the lower whorls are smooth. The last whorl is a little concave below the suture. Aperture fully half the length of the shell; outer lip thickened and somewhat varicose, lirate within, toothed on its outer edge; canal short, truncated; inner lip callous, the callus rising into a lip. There are frequently a few denticles on the base of the columella. On the parietal wall at the upper end of the aperture there are two white plaits, and above this there is a canal. Color purplish brown, with narrow, revolving, darker bands, which are articulated with arrowheaded white spots.

Length, 45; diameter, 20 mm.

Caballo Blanco Reef, Vieques.

Genus TRITONIDEA Swainson, 1840

Shell bucciniform, generally cancellated, having a thick epidermis; spire pointed; aperture elliptical, canaliculate above; outer lip thickened and varicose, lirate within; columella concave; parietal wall with a tooth above. Operculum unguiculate.

Tritonidea tincta Conrad.

Pollia tincta Conrad, Proc. Acad. Nat. Sci. Phila. 1846, p. 25, pl. I, fig. 9, 1846.

Shell with a conical spire, the whorls but slightly convex, with low rounded longitudinal ribs, which are crossed by revolving riblets. Between these riblets there are revolving liræ, and there is a constriction at the upper part of the shoulder which cuts off the longitudinal ribs and leaves a row of nodules. Outer lip thick, varicose, strongly ridged within; inner lip generally having a series of nodulous plaits, and one strong plait above just below the angle. Color purplish brown, variegated and clouded with white, the clouding often in somewhat longitudinal patterns.

Length, 25; diameter, 15 mm.

Cabo Rojo Light, Porto Rico, a few worn shells; West Indies; also found on the Florida coast.

Tritonidea tincta var. **bermudensis** Dall.

Tritonidea var. *bermudensis* Dall, U. S. Nat. Mus. Coll.

Shell smaller, more slender and delicate than the type and with rather sharper sculpture.

Boqueron Bay, Porto Rico, one shell; also in Bermuda.

Tritonidea auritula Link.

Nassaria auritula Link, Beschr. Rostock Samml., III, p. 124, 1807.
Buccinum coromandelianum Reeve, Conch. Icon., III, pl. IX, fig. 62, 1846.

Shell solid, rather short; spire conoidal; whorls slightly rounded, the last with about eleven strong longitudinal ribs which are carried up the spire; whorls high, shouldered, with the surface concave above; the revolving sculpture consists of strong ribs (ten to twelve on the last whorl), and besides these ribs there are everywhere intermediate threads that are slightly decussated by the growth lines. Just below the suture there is a row of strong nodules. Outer lip varicose, having a very prominent tubercle where the subsutural row ends, strongly ridged within. Columellar area tubercular with a strong, deep, entering plait above. Color brownish, clouded irregularly with white.

Length, 22; diameter, 15 mm.

Aguadilla, Porto Rico; Ensenada Honda, Culebra; Caballo Blanco Reef, Vieques; several dead shells.

Though normally quite different from *T. tincta*, the two forms often approach each other until it is difficult to separate them, and each has often been taken for the other. This species is shorter and in general solider than *tincta;* it has a more pronounced shoulder, and the strong tubercle at the upper part of the outer lip is a decided character.

Tritonidea orbignyi Payraudeau.

Buccinum orbignyi Payraudeau, Cat. Moll. de Corse, p. 159, pl. VIII, figs. 4-6, 1826.

Shell rather small, with eight whorls which vary from flattened to rounded, covered with longitudinal rounded ribs (from twelve to fifteen on the last whorl) and numerous revolving ribs, the whole being overlaid with revolving threads; outer lip varicose, toothed within; aperture somewhat elongated; canal slightly produced; columella wrinkled. Color brownish yellow with darker markings on the back of and between the ribs, with a narrow white band below the periphery

Length, 18; diameter, 10 mm.

Ponce, Porto Rico, one shell; Culebra, one young specimen.

An abundant form in the Mediterranean.

Genus NASSARINA Dall, 1886.

Shell with the general characters of *Nassaria* but more compact, spindle-shaped, and small; aperture long, columbelliform, and narrowed below; columellar margin elevated and united above by a high callus with the outer lip.

Nassarina glypta Bush.

Mangilia? glypta Bush, Trans. Conn. Acad. Sci., VI, p. 461, pl. XLV, figs. 5, 5*a*, 1885.

Shell with about eight whorls which are but slightly rounded, but which are separated by a very deep, sharply defined suture; sculpture consisting of rounded longitudinal ribs, and these are cut by shallow, revolving grooves into low, irregular nodules; aperture ovate-elongate, narrowed and turned back below. Color whitish, with a faint, revolving brown band below the suture and another on the base of the shell.

Length, 3.5; diameter, 1.5 mm.

Mayaguez, Porto Rico, one worn shell.

Nassarina metabrunnea, n. sp. Plate 57, fig. 16.

Shell small, solid, acute, whitish, with the apical region brown and also the pillar and canal; suture appressed; shell sculptured with numerous axially directed, narrow, close-set ribs, persistent to the base, crossed by fine spiral threads with wider interspaces, substantially as figured; nepionic whorls three, smooth, polished; sculptured whorls about five and a half; outer lip internally lirate; inner lip smooth.

Length, 6.5; maximum diameter, 2.5 mm.

Mayaguez Harbor, Porto Rico.

Much more delicate and different in sculpture from the preceding and the following species. The color may vary, but if not it would be well distinguished by its white shell with two brown ends.

Genus PHOS Montfort, 1810.

Shell oval-oblong, acuminate, turriculated, cancellated; spire elevated; aperture oval-elongate; lip ridged within and having a small sinus below; base sharply notched; columella with one or two folds at the base. Operculum claw-shaped, slightly curved, nucleus apical.

Phos candei d'Orbigny.

Cancellaria candei d'Orbigny, Moll. Cuba., II, p. 129, pl. XXI, figs. 23-25, 1845.

Shell with nine or ten rounded whorls, the first two or two and a half having merely a sharp, revolving, central keel; below this it is sculptured with numerous slightly curved, longitudinal ribs (about sixteen on the last whorl), which are crossed by revolving threads of three sizes, alternating one with the other, and the surface is minutely decussated by fine growth lines; aperture ovate-elongate; outer lip thick, with a varix some distance back of its edge, and in some examples there are varices scattered over the shell; the liræ on the inner side of the outer lip extend in for half a whorl or more; notch near the base of the lip well marked, sometimes quite decided, as in *Strombus;* notch at the base deep; columella with two folds at its base, the upper faint; sometimes there are a few nodulous plaits above, and there is a plait at the upper part of the parietal wall. Color yellowish white to brownish, with darker, faint, broken bands.

Length, 25; diameter, 12 mm.

Aguadilla; Mayaguez, Porto Rico.

A large number of specimens were received, dry and alcoholic, showing a great deal of variation. In some specimens there are varices scattered over the shell, marking all the rest periods; in others there is only the one varix behind the outer lip. The degree of coarseness of the sculpture varies much, and in some shells the color is stronger where the bands cross the ribs.

Phos parvus C. B. Adams.

Triton parvus C. B. Adams, Contr. to Conch., 1850, p. 59.
Phos intricatus Dall, Proc. U. S. Nat. Mus., VI, p. 325, pl. X, fig. 9, 1883.

Shell rather small, with about eight whorls, which are separated by a deep suture; sculptured with eleven strong, distinct, elevated, rounded, longitudinal ribs; these are crossed by sharp, revolving riblets, which form nodules on the longitudinal ribs; one of these above the center of the whorls is stronger, causing the shell to be shouldered; there are fine, revolving threads between the ribs which cross the growth lines, making the surface finely reticulate; aperture elongate-ovate; varix just behind the outer lip very high and strong; the subbasal notch of the lip feeble; columella scarcely plicate below. Color pale brownish, the nodules darker; there is a white band below the middle of the body whorl that shows on the bases of the upper whorls.

Length, 16; diameter, 7 mm.

Mayaguez Harbor, Porto Rico, one shell.

Phos oxyglyptus, n. sp. Plate 57, fig. 18.

Shell small, delicately and sharply sculptured; nepionic whorls three, polished, peripherally keeled smooth; subsequent whorls six, sculptured as in *P. candei* d'Orbigny, with subequal axial and spiral ridges and occasional varices; between the primary spirals is usually a minute intercalary thread (not shown in the figure); aperture lirate on pillar, body and outer lip, the latter with a deep sinus, as in *Strombus*, near its anterior end.

Length, 17; maximum diameter, 6.5 mm.

Mayaguez, Porto Rico, two specimens.

This species is near to *P. candei*, from which it differs by its smaller size, more delicate sculpture, proportionally deeper labial sinus, and absence of brown flammulation. In a specimen of *P. candei* of the same length as the adult *P. oxyglyptus*, the shell is more conical and the last whorl emphatically wider.

Genus STRONGYLOCERA Mörch, 1852.

Shell with elevated, sharp spire, cancellated; the whorls slightly shouldered above; aperture long-ovate; outer lip somewhat thickened and lirate within, not emarginate below; columella sharply twisted and having one or two folds below. Operculum lozenge-shaped, pointed in front and behind, concentric with a nearly central nucleus, something like that of *Buccinum*.

Strongylocera unicincta Say.

Nassa unicincta Say, Journ. Acad. Nat. Sci. Phila., v, p. 211, 1826.
Phos guadeloupensis Tryon, Man., III, p. 219, pl. LXXXIII, figs. 512, 520, 1881.

Shell with eight or nine somewhat rounded, slightly shouldered whorls, with nearly straight, longitudinal, rounded ribs (about twelve on the last whorl); these are crossed by alternately coarser and finer revolving ridges; outer lip thickened, strongly ridged within; base deeply notched; aperture long-oval; columella raised into a slightly elevated inner lip, with one revolving rib on its base and a faint one above it. To the left of the columella near the base there is a strong, low, revolving ridge that ends at the basal notch; parietal wall without a ridge above. Color varying from whitish or bluish white to light or dark brown. There is generally a narrow dark band below the shoulder, and there are often dark blotches at the suture.

Length, 22; diameter, 11 mm.

Ponce; San Juan; Fajardo, Porto Rico.

This species has been placed in both *Nassa* and *Phos*, but the operculum is quite different from that of either.

Genus ENGINA Gray, 1839.

Shell oval-conic, thick, nodulous; spire acuminate; lip thick, denticulate within; canal truncated; columellar border wrinkled. Operculum claw-shaped, summit sharp, the nucleus apical.

Engina turbinella Kiener.

Purpura turbinella Kiener, Coq. Viv., p. 29, pl. IX, fig. 25, 1835.

Shell rather short, seven-whorled, with a nearly straight, conical spire; there is a well-defined ridge or carina at the periphery, and below this the shell tapers evenly to the base; there is a row of low tubercles just above the suture, extending around the periphery of the last whorl, and these tubercles sometimes are continued as faint, longitudinal ribs; the surface is finely reticulated with delicate, revolving threads which cross the growth lines; aperture long-ovate, somewhat narrowed and drawn out below; outer lip thickened and varicose, with from four to six nodules within, the upper separated some distance from the others; under lip having a sharp, raised edge, and slightly nodulous-wrinkled.

Color reddish brown to black. There is a white band at the row of nodules, which is often broken so that only the nodules are white.

Length, 11; diameter, 7 mm.

Ponce; Puerto Real; Aguadilla, Porto Rico; Ensenada Honda, Culebra; numerous dead and worn shells.

Family NASSIDÆ.

Genus NASSA Lamarck, 1799.

Shell imperforate, solid, oval to elongated; spire pointed; aperture oval; lip thickened by a varix, lirate within; border of the columella reflected over the ventral part of the shell, often forming a heavy, widespread callus; columella twisted and truncate at the base, with a single fold below. Operculum oval or unguiform, its edges toothed, truncate at the apex, its nucleus apical.

Nassa vibex Say.

Nassa vibex Say, Journ. Acad. Nat. Sci. Phila., II, p. 231, 1822.
Nassa vibex Say, Am. Conch., pl. LVII, fig. 2.

An exceedingly abundant, widespread, and variable species, and it is difficult to give a description which will cover all the mutations. The shell varies from being quite obese to elevated; it has eleven or twelve longitudinal ribs; these are crossed by finer, revolving ridges or threads which make the summits of the longitudinal ribs somewhat nodulous. The shell is somewhat shouldered and is sometimes almost concave above the shoulder; below the suture there is an elevated, revolving ridge, which is sometimes cut into nodules by the longitudinal sculpture. The aperture is short, with a canal above, and is somewhat rhomboidal in shape. The outer lip is thickened and has from four to ten liræ within. The columellar callus spreads over the under side of the shell, and is sometimes thick and strong, and sometimes thin; it is slightly nodulous or wrinkled within the opening. The color varies from nearly white through ashy to dark brown or nearly black, and there is generally a light band at and above the periphery; the callus and lip are whitish or yellowish.

Length, 10 to 15; diameter, 6 to 10 mm.

San Juan, Porto Rico, a number of specimens; West Indian region, and the southeastern United States.

Nassa ambigua Montagu.

Buccinum ambiguum Montagu, Test. Brit., pl. IX, fig. 7, 1803.

Another abundant and exceedingly variable species. It is a short, rather solid form, with generally well-rounded or shouldered whorls, and a distinct, deep suture, which is sometimes canaliculate. There are thirteen or fourteen nearly straight, well-defined, rounded ribs, which are continuous from suture to suture, or to the base of the shell, and in addition there are distinct growth lines. These are crossed by numerous fine, revolving ridges, which are sometimes even and occasionally larger and smaller alternately. The aperture is small and almost round; the outer lip is thickened. Color white or yellowish, generally spotted or irregularly banded with brown.

Length, 8 to 15; diameter, 5 to 9 mm.

Aguadilla; Mayaguez, Porto Rico; Ensenada Honda; West Indian region; also (incorrectly?) reported from the west coasts of Africa and southern Europe.

Nassa hotessieri d'Orbigny.

Nassa hotessieri d'Orbigny, Moll. Cuba, II, p. 142, atlas, pl. XXI, figs. 40–42, 1845.

A number of young specimens and shells in bad condition were taken at Mayaguez and Ponce, and off Vieques, which are probably the above, but are hardly well enough preserved for positive identification.

Family COLUMBELLIDÆ.

Genus COLUMBELLA Lamarck, 1799.

Shell oval, strombiform or somewhat elongated; aperture rather elongated, terminated by a short canal; outer lip thickened in the middle, generally toothed within; columella toothed or plicate; the base of the shell is narrowed.

Subgenus COLUMBELLA s. s.

Shell strombiform, with a rather short spire; aperture long, curved, narrow; outer lip thickened, incurved and swollen in the middle, toothed within, shouldered above; base notched; columella with several teeth or folds below; the lower part of the shell somewhat narrowed and drawn out; operculum unguiculate; nucleus apical.

Columbella mercatoria (Linnæus) Lamarck.

Voluta mercatoria Linnæus, Syst. Nat., ed. X, p. 730, 1758.
Columbella mercatoria Lamarck, An. sans Vert., VII, p. 294, 1822.
Columbella mercatoria Kiener, Coq. Viv., Columbella, p. 23, pl. V, fig. 1, 1841.

This is one of the most abundant marine mollusks in the West Indian region. The shell is generally solid and somewhat cone-shaped; the spire is moderately elevated, the whorls are rounded or sometimes shouldered; the surface is covered with strong, revolving ridges, though occasional specimens are nearly smooth, and it is marked by rather strong growth lines, which are most conspicuous between the ridges. The outer lip is thick and is somewhat shouldered and ascending above; it is decidedly thickened and incurved in the middle, and strongly toothed within throughout its length. The columella has six or eight teeth and is callous, and usually biplicate within. The color pattern is infinitely variable; often white and brown or white and yellowish brown in irregular longitudinal clouds or zigzags. In many cases the dark color is found only on the ridges in dots or lengthened markings, and there are often two or more ridges with darker markings than the rest, or white and dark markings arranged alternately.

Length, 15 to 22; diameter, 10 to 15 mm.

San Juan; Aguadilla; Arroyo; Ponce; Mayaguez; Puerto Real, Porto Rico; Culebra. A small variety was obtained at Ponce and Boqueron Bay, Porto Rico.

Subgenus ANACHIS H. & A. Adams, 1853.

Shell oval fusiform, longitudinally ribbed; spire elevated; last whorl but little narrowed in front; outer lip nearly straight, crenulated within.

Columbella pulchella Kiener.

Columbella pulchella Kiener, Thes. Conch., I, p. 131, pl. XXXIX, figs. 121, 122, 1847.

Shell with about eight slightly rounded whorls; spire acuminate, gradually tapering; delicately longitudinally ribbed, the ribs on the upper whorls strongest; covered throughout with fine, revolving liræ or threads; outer lip nearly straight in the middle, slightly thickened, nearly or quite smooth within, faintly notched above; columellar callus raised into a little lip at its edge, faintly nodulous. Color yellowish white variegated with brown, the brown pattern often inclosing rounded white spots of different sizes; there is generally an irregular white band just below the periphery.

Length, 9; diameter, 3 mm.

Playa de Ponce; Puerto Real, Porto Rico; Ensenada Honda, Culebra; Vieques.

Columbella iontha Ravenel.

Columbella iontha Ravenel, Proc. Acad. Nat. Sci. Phila., 1861, p. 42; Tryon, Am. Mar. Conch., p. 40, 1873; Man., V, p. 144, pl. 52, fig. 76(?), 1883.

Mayaguez, Porto Rico, one specimen.

This may be identical with *C. pretrei* Duclos, which is probably prior to *C. albella* C. B. Adams (1850, as *Pleurotoma*), which appears to be merely a mutation of Duclos's species, as identified by cotypes from Adams.

Columbella catenata Sowerby.

Columbella catenata Sowerby, P. Z. S., 1844, p. 52.
Columbella catenata Sowerby, Conch. Icon., XI, pl. XXI, fig. 119, 1858.

Shell with about eight nearly flat whorls, sculptured with rather strong, straight, longitudinal ribs and faint revolving liræ; outer lip slightly notched above, and below this notch it is thickened. Within it there are five or six denticles. Base of the shell slightly contracted; columella with feeble nodules. Color dirty white with a supramedian and basal band of dark, tessellated markings.

Length, 8; diameter, 3.5 mm.

Mayaguez Harbor, one shell.

Columbella obesa C. B. Adams.

Buccinum obesum C. B. Adams, Proc. Bost. Soc. Nat. Hist., 1845, p. 2.
Columbella obesa Tryon, Man., V, p. 169, pl. LVII, figs. 7-9, 20, 1883.

Shell small, with nearly plain whorls, rather stout, sculptured with strong, straight ribs, which fade out on the back of the body whorl, and revolving threads; base contracted a little; outer lip varicose, feebly notched above and toothed within; columellar callus raised into an edge, smooth; yellowish or whitish, more or less banded with light or dark brown.

Length, 5; diameter, 2.5 mm.

San Juan Harbor, four specimens.

Columbella calliglypta, n. sp. Plate 57, fig. 13.

Shell small, stout, solid, yellowish white, polished, with rather short and acute spire and about seven whorls; the nepionic whorls (missing) are followed by five subsequent whorls, at first smooth, then axially ribbed, and finally reticulated by spiral sulci; on the antepenultimate whorl the ribbing is close and feeble, on the penultimate clear-cut, slightly flexuous, with a presutural sulcus; on the last whorl the ribbing extends nearly to the canal, with two presutural grooves, and in front of them a space without spirals, then that part of the shell which would be covered by the advancing whorl is evenly, regularly, sharply grooved to the anterior end of the canal; the ribs are slightly flexuous and feebly nodular at the suture and are separated on the last whorl by gradually widening interspaces; the outer and pillar lips are both thickened and lirate within.

Length, 6.5; maximum lat., 3.5 mm.

A single specimen at Aguadilla, Porto Rico.

This species belongs to the same group as *A. obesa* C. B. Adams, which is smaller, ruder, and much less elegantly sculptured. The color is probably variable; the type specimen seems more or less bleached.

Subgenus ASTYRIS H. & A. Adams.

Shell generally small, smooth, usually polished.

Columbella duclosiana d'Orbigny.

Columbella duclosiana d'Orbigny, Moll. Cubana, II, p. 136, pl. XXI, figs. 31-33, 1845, not of Sowerby, Thes. Conch., No. 8, 1847.

Shell small, with six slightly rounded whorls, rather short, smooth and shining; outer lip with a slightly thickened varix, feebly notched above, smooth within; base of the shell but little contracted; columella deeply excavated about at the middle; the few revolving ridges at the base are continued over it. Color white or yellowish white, sometimes maculated near the suture.

Length, 3; diameter, 1.5 mm.

Mayaguez, Porto Rico, one worn shell.

This is close to *C. lunata* and may be only a variety of it. The name *duclosiana* was also used for a *Columbella* by Sowerby for a species from Java, which, if valid, will have to receive a new name.

Columbella perpicta, n. sp. Plate 57, fig. 12.

Shell of moderate size, rather thin, nearly smooth, elegantly fusiform, waxen white with brown flammulations; whorls seven, the latter ones with a faint striation just in front of the suture and somewhat stronger spiral sulci on the canal and base; body of the whorl without spiral sculpture; outer lip externally marginate, internally delicately lirate; pillar lip smooth or feebly obliquely striated near the canal.

Length, 10.5; diameter, 4.5 mm.

Mayaguez, Porto Rico, not uncommon in about 100 fathoms.

The only Antillean species with which this can well be compared is *C. saintpairiana* Caillet, which is larger, of a different shape, and axially ribbed near the apex.

Genus NITIDELLA Swainson, 1840.

Shell oval to elongated, smooth, rather solid, with elevated spire; aperture somewhat effuse below; outer lip slightly thickened and swollen in the middle, toothed within; operculum oval; nucleus subcentral.

Nitidella nitidula Linnæus.

Buccinum nitidulum Linn., Syst. Nat., ed. X, p. 741, 1758.
Columbella nitidula Sowerby, Genera, pl. XL, fig. 162, 1847.

Shell oblong-oval, with about seven slightly convex whorls; spire moderately elevated; aperture elongate, narrow above, somewhat effuse below; outer lip thickened a little, thicker in the middle, where it is straight or faintly incurved, ascending the spire above, toothed within, the spaces between the teeth darker. There are two small, scarcely oblique ridges below the middle of the columella. Shell smooth and shining throughout, reddish-brown blotched and spotted with white, the light markings generally forming a faint band below the suture and below middle of body whorl.

Length, 15; diameter, 8 mm.

Aguadilla; Playa de Ponce; Hucares; Guanica, Porto Rico; many shells.

Nitidella lævigata Linnæus.

Buccinum lævigatum Linn., Syst. Nat., ed. x, p. 741, 1758.
Columbella lævigata Tryon, Man., v, p. 113, pl. XLVI, figs. 16–21, 1883.

Shell with about six somewhat rounded whorls, which are faintly shouldered, smooth and shining; suture well marked, sometimes almost canaliculate; aperture long-ovate; outer lip slightly thickened, but not inflected or callous in the middle, toothed within; columella excavated above, with two folds at its base. Color rich reddish brown, with longitudinal zigzag white markings; sometimes the white predominates and the bands are brown. There is a row of very dark spots above the suture and on the middle of the body whorl, which often has alternating white spots, though it is sometimes wanting; sometimes there are two such bands on the body whorl. There is often a row of large white blotches below the suture; aperture white.

Length, 17; diameter, 8 mm.

Aguadilla; Hucares; Ponce; Arroyo, Porto Rico.

Nitidella cribraria Lamarck.

Buccinum cribrarium Lamarck, An. sans Vert., VII, p. 274, 1822.
Columbella cribraria Sowerby, Conch. Icon., XI, pl. XIII, fig. 62, 1858.

Shell solid, rather narrow, with faint, revolving striæ, which are almost obsolete except at the base; whorls nearly flat, the upper one or two very often decollated; outer lip thickened, notched, and ascending above, toothed within, straight in the middle; columella nearly straight, slightly twisted, smooth, not plicate below. Color dark reddish brown, covered with white spots. There are sometimes one or two bands of lighter brown on the body whorl. There is frequently a narrow, darker band just below the suture, which is broken with large, squarish, white spots.

Length, 10; diameter, 4 mm.

Guanica; Puerto Real; Hucares, Porto Rico, many shells, all quite dark and decollated.

?Genus PYRENE Bolten, 1798.

Shell ovate or subconic, with a convex spire; outer lip thickened and inflected in the middle and toothed within; aperture long, narrow, incurved at the middle; columellar plications wanting; external surface smooth.

Type, *Columbella semipunctata* Lamarck.

Pyrene ovulata Lamarck.

Columbella ovulata Lamarck, An. sans Vert., VII, p. 295, 1822.
Columbella ovulata Kiener, Coq. Viv., *Columbella*, p. 40, pl. XIV, fig. 3, 1841.

Shell ovate-conic, moderately solid, with faint, revolving ridges, which are scarcely discernible on the middle of the body whorl, the shell appearing to be smooth; spire moderate, somewhat convex, the whorls being rounded a little and separated by a deep, almost canaliculate suture; aperture long, narrow, but little wider below; outer lip slightly swollen, thickened, and incurved a little in the middle toothed within, ascending the spire decidedly, sometimes to the suture above the penultimate whorl; columella slightly curved in the middle to correspond with the incurving of the outer lip, hardly plicate below. Color rich reddish brown, sometimes very dark, with irregular white clouds and spots, often forming an indistinct central band.

Length, 15; diameter, 8 mm.

Aguadilla, Porto Rico, one shell; West Indian region generally.

There is some variation in the form of this species, certain specimens being more or less attenuated.

Family MURICIDÆ.

Subfamily MURICINÆ.

Genus MUREX Linnæus, 1758.

Shell having a prominent, pointed spire; whorls convex, bearing longitudinal, spiny, foliaceous or tubercled varices; aperture round, terminated by a straight canal; operculum oval; nucleus subapical.

Subgenus MUREX s. s.

Canal long and straight; varices three, spinous or tuberculate.

Murex messorius Sowerby.

Murex messorius Sowerby, P. Z. S., 1840, p. 137.
Murex messorius Sowerby, Conch. Illus., *Murex*, fig. 93, 1839.

Shell with a moderate, conical spire, and a long, straight, or slightly recurved canal; varices three, with two to three intervarical ribs; the revolving sculpture consists of rather sharp ridges, with a single thread between; there is often a short spine near the upper end of the varices, and one or two below them on the canal; the lower spines are sometimes recurved; epidermis hispid; color purplish or pinkish.

A single young, broken specimen of what is probably this was obtained at Mayaguez.

Murex antillarum Hinds.

Murex antillarum Hinds, P. Z. S., 1843, p. 126.
Murex nodatus Reeve, Conch. Icon., III, 1845, pl. XXV, fig. 107.

Shell subfusiform, with about nine whorls, the first one and one-half smooth; the three varices are rounded, elevated, scarcely at all frilled, and have on the shoulder a short, nearly straight, sharp spine; there are often two other sharp, short spines at the bases of the varices on the canal, and sometimes a few short, spiny processes along the middle of the varices; canal moderately long, generally recurved, though sometimes straight; the surface is covered with larger and smaller alternating revolving ridges, and between the varices there are three or four low, longitudinal ribs, which are cut into rather sharp tubercles by the revolving sculpture. Color whitish, with broken, revolving, brown lines and markings, which sometimes form faint bands.

Length 50; diameter, measuring across the short spines, 25; diameter of the shell, 21 mm.

A single remarkably fine, living specimen was taken at Mayaguez.

Hinds described the species as *M. antillarum* in 1843 and referred to a figure in the Conchological Illustrations which Mr. Sowerby mentioned as a variety of *M. motacilla*. Reeve afterwards, in the Conchologia in 1845, described the same thing, calling it *M. nodatus*, and referred to the same figure in the Illustrations. Reeve gave a beautiful figure, and was probably not aware that Hinds had described this shell under another name.

Subgenus CHICOREUS Montfort, 1810.

Shell with elevated spire and a canal of moderate length; varices three, generally foliaceous; inner lip seldom raised into a lamella.

? **Murex rufus** Lamarck.

A single very young specimen in bad condition was obtained at Puerto Real, Porto Rico, which may be this species, which is widespread in the Antilles.

Murex brevifrons Lamarck.

Murex brevifrons Lamarck, An. sans Vert., VII, p. 161, 1822.
Murex calcitrapa Reeve, Conch. Icon., III, pl. III, fig. 13, 1845.

Shell large, solid, the three varices frondose; sometimes there is a row of secondary, smaller fronds in front of the larger ones. There is a single strong intervarical rib, which sometimes becomes almost a hump; the spire and canal are somewhat elongated and of about equal length; the latter is frondose to its base; the revolving sculpture consists of low, somewhat separated ridges, and besides this the shell is everywhere covered with revolving, roughened or slightly nodulous threads. The color is whitish or brownish, with revolving darker often blackish narrow bands, which are sometimes very distinct.

Length 100; diameter, 60 mm.

Off Point Melones; Mayaguez; Arroyo; Boqueron Bay, Porto Rico; Ensenada Honda, Culebra; West Indies generally.

Subgenus PHYLLONOTUS Swainson.

Shell generally more inflated than in *Chicoreus* and having from four to numerous varices; inner lip raised into a thin lamella.

Murex pomum Gmelin.

Murex pomum Gmelin (ex parte), Syst. Nat., p. 3527, 1792.
Murex pomum Reeve, Conch. Icon., III, 1845, pl. IX, fig. 35.

Shell variable in size, form, and coloring, rather solid, with a moderate spire and canal of equal length, with three to four heavy varices; there are one or two, sometimes three, intervarical ribs, which are generally strong and often knoblike. Throughout, the shell is covered with strong ribs, which often break into tubercles, and besides these there are generally revolving, broken threads. Frequently the growth lines are raised into lamellæ, and the entire surface becomes frilled. The surface is generally variegated with whitish and fulvous brown; sometimes the shell is imperfectly banded. The aperture may be nearly white, yellow, or brownish orange, and it is frequently marked with very dark brown.

Length, 50 to 85; diameter, 30 to 50 mm.

Cabo Rojo light, two badly worn shells; West Indian region; Florida, etc.

On the west coast of Florida and in some other localities this species seldom attains a large size, has usually three varices, and presents much the aspect of a *Chicoreus*. In the Bahamas and West Indies it often attains a much larger size and is more or less perfectly four-variced, and has the appearance of a true *Phyllonotus*.

Murex micromeris Dall. Plate 53, fig. 17.

Murex micromeris Dall, Trans. Wagner Inst., III, p. 141, pl. 12, fig. 12, 1890.

Shell small, with a somewhat elevated spire and a rather short canal, with about seven varices, and alternately larger and smaller revolving ridges; whorls about six; aperture ovate, canal slightly reflexed, rather open, bases of the former canals showing distinctly; inner lip scarcely elevated; outer lip lirate within. Color salmon red.

Length, 5.5; diam., 3 mm.

Boqueron Bay, Porto Rico, one shell.

The relationships of this little species are somewhat doubtful. The spire is more elevated and is larger in proportion to the size of the body whorl than is the case in most species of *Phyllonotus*, and the edge of the inner lip is appressed to the last whorl instead of being elevated as it generally is in that subgenus.

Subgenus FAVARTIA Jousseaume, 1880.

Shell small, with from four to eight varices and a series of revolving ridges; surface rasp-like, covered with longitudinal ribs, which are vaulted on the ridges, and which form pits in their interstices; canal short, recurved.

Murex cellulosus Conrad.

Murex cellulosa Conrad, Proc. Acad. Nat. Sci. Phila., III, p. 25, 1846.
Murex nuceus Mörch, Cat. Kierulf, p. 14, pl. I, fig. 9, 1850.

Shell with about seven whorls, the first one and a half smooth, the others with from six to eight varices, and covered with revolving ridges; in some cases the space between the longitudinal ribs is nearly smooth, there being a series of deep pits at each side of this smooth space; in other cases the revolving ribs are continuous. The longitudinal frills characteristic of the subgenus may be faint or excessively developed; these frills are strongest on the longitudinal ribs. Often they form a series of square pits where they cross the spaces between the ribs. The aperture is exactly elliptical; the canal is moderately short, reflexed, and nearly closed; the former canals stand out with great distinctness; the inner lip is generally somewhat raised. Whitish or brownish, sometimes banded with brown.

Length, 20; diameter, 10 mm.

Mayaguez, Porto Rico, one very fine shell and one young specimen.

Murex intermedius C. B. Adams.

? *Murex alveatus* Kiener, Icon., *Murex*, pl. 46, fig. 2.
Murex intermedius C. B. Adams, Cont. to Conch., 1850, p. 60.

Shell somewhat elongated, ovate fusiform, with about six or seven varices; the whorls are often more or less shouldered and are covered with a series of strong revolving ridges. Throughout the shell there are delicately crimped longitudinal frills. Sometimes the revolving ridges between the larger ones are flattened as though they had been pressed when in a soft state; canal rather short, nearly closed when the shell is fully adult. Color ashy white, often faintly banded with brownish.

Length, 20; diameter, 10 mm.

Mayaguez, Porto Rico; Vieques. One young shell from each, that from the former having the ribs compressed.

This species is distinguished from Kiener's figure of *alveatus* by its more acute apex and its more dense and frothy sculpture of the revolving ridges; but we do not feel assured of their specific distinctness in the absence of specimens of *M. alveatus*.

Genus MURICIDEA (Swainson) Mörch, 1840.

Shell with elevated spire and a canal of moderate length, longitudinally ribbed, but lacking the primary varices of *Murex;* operculum fusoid, with an apical or almost apical nucleus.

A genus of doubtful homogeneity. In such species as *M. floridana* and *M. multangula* there are only longitudinal ribs, which are not at all varix-like. In others the ribs take on the nature of varices to some extent, and are sometimes as well developed as in the typical Murices.

Subgenus MURICIDEA s. s.

Muricidea hexagona Lamarck.

Murex hexagonus Lamarck, An. sans Vert., VII, p. 169, 1822.
Murex hexagonus Reeve, Conch. Icon., III, pl. XXVII, fig. 120, 1845.

Shell rather elongated, with eight or nine whorls, and six spiny rib-like varices; spines short, slightly upcurved, only a single one to each varix on the upper whorls, about six on each varix of the body whorl and the canal; these are open in front; sculpture consisting of low, rather sharp, revolving ribs, which on the varices develop into the spines; the spaces between these ribs is concave. Outer lip toothed within; inner lip generally somewhat raised at its edge. Color whitish; the spines often purple, and sometimes the shell has purplish tints.

Length, 35; diameter, across the spines 23, across the body whorl 15 mm.

Ponce Reefs, Gallardo Bank, Porto Rico.

Subgenus PSEUDONEPTUNEA Kobelt, 1882.

Muricidea multangula Philippi.

Fusus multangulus Philippi, Zeits. für Mal., V, 1849, p. 25; Abbild. und Beschr., III, p. 117, pl. XXIV, fig. 6, 1850.

Shell with eight somewhat shouldered whorls, which are crossed by about seven strong, rounded, longitudinal ribs; the surface is covered with revolving sculpture consisting of rather strong threads, of which about every fourth one is larger; aperture ovate-elongate; outer lip hardly thickened, feebly lirate within; canal short, open; columella curved, with a single ridge below; behind it there is a false umbilicus. Color yellowish or whitish, with small brown spots or blotchings, which are sometimes imperfectly arranged in longitudinal and revolving series. Sometimes there are faint longitudinal streaks, and occasionally the shell is feebly banded.

Length, 30; diameter, 17 mm.

One very young shell was obtained at Mayaguez.

Genus ASPELLA Mörch, 1877.

Shell elongated, with elevated spire and a short, recurved, nearly closed canal; surface of a peculiar spongy or chalky white character, which when worn away reveals a shell of solid texture, white or brownish; there is a set of two or three principal varices and often a smaller secondary set, and besides these there are sometimes irregular longitudinal ribs; surface covered with revolving striæ, often somewhat pitted; aperture small, elliptical; outer lip usually feebly toothed; there is a false umbilicus at the base of the columella.

Type, *Ranella anceps* Lamarck.

There is a general agreement of the important characters of the species forming this group, the peculiar texture, form of canal and aperture, revolving sculpture, and varices being found in all of them. There is much variation in the longitudinal sculpture of the species. *A. anceps* often has a double row of varices on each edge of the flattened shell, a larger and a smaller one; sometimes it has only a single row on each edge, and there is a tendency in the other species to occasionally assume this *Ranella*-like arrangement of the varices. Reeve's figure in the Conchologia Iconica of *Ranella hastula*, a member of this group, is somewhat misleading, as it represents a rich brown shell with yellow varices.

Aspella scalaroides Blainville.

Murex scalaroides Blainville, Faune Française, p. 131, pl. v, figs. 5, 6, 1826.

Shell elongated, with elevated spire and short, recurved canal, with eight whorls; principal varices three, with three smaller, intermediate ones which sometimes degenerate into ribs, with strong revolving ridges; surface covered with fine revolving threads, the spaces between the revolving ridges pitted at the principal varices and sometimes at the smaller ones; surface chalky or spongy, whitish, revealing, when eroded, the hard, milky-white layer beneath; aperture elliptical; outer lip somewhat toothed within.

Length, 25; diameter, 10 mm.

Puerto Real, Porto Rico, one young shell.

The young shells of this species have a resemblance to *Trophon*.

Subfamily PURPURINÆ.

Genus PURPURA Bruguière, 1789.

Shell with short to moderate spire and large aperture; surface sculptured, but not varicose; columella arched, generally flattened, sometimes excavated; canal short, with a deep notch; operculum with the nucleus at the middle of one side.

Purpura patula Linnæus.

Buccinum patulum Linnæus, Syst. Nat., ed. x, p. 739, 1758.
Purpura patula Reeve, Conch. Icon., III, pl. 1, fig. 3, 1846.

Shell large, ovate, with a short spire, the whorls rounded; sculpture consisting of revolving rows of rather sharp tubercles, which are less distinct in the mature shells, and in addition to this the whole surface is covered with revolving threads, which are slightly decussated by the growth lines; aperture very large, elliptical, patulous; outer lip with a series of short ridgelike teeth within the border; canal small, scarcely notched on the base; columella arched, very wide, and more or less excavated. Color blackish brown, often lined or irregularly banded with white. The adult shells are generally so eroded that the color can not be made out. The inside of the outer lip is bordered with dark brown, the interior is coppery or bluish, the columella is light brown sometimes shaded with white, and there is a very dark patch at its upper left-hand part.

Length, 80; diameter, 55; of aperture, 70; width of aperture, 50; width of columella, 23 mm.

Hucares; San Juan; Aguadilla; Guanica; San Geronimo, Porto Rico; West Indian region generally.

Purpura hæmastoma var. **undata** Lamarck.

Purpura undata Lamarck, An. sans. Vert., VII, p. 238, 1822.
Purpura fasciata Reeve, Conch. Icon., III, pl. IX, fig. 45, 1846.

This variety of the common variable and widely distributed *P. hæmastoma* is common through the West Indian region and the Florida Keys. In general it is rather slender and has a couple of rows of low tubercles on the body whorl, one of these continuing up the spire, and from this it varies to forms that are almost smooth. All the specimens have low revolving threads more or less developed. The color is purplish brown, more or less fasciate or blotched with white, the aperture bluish and generally fasciate.

Length, 30; diameter, 20 mm.

Aguadilla; San Geronimo; Mayaguez; San Juan, Porto Rico; Caballo Blanco Reef, Vieques; Culebra.

Purpura hæmastoma var. **floridana** Conrad.

Purpura floridana Conrad, Journ. Acad. Nat. Sci., Phila., VII, pl. XX, fig. 21, 1837.

A little larger than the variety *undata*, with or without two rows of low tubercles, with rather strong, revolving sculpture. Whitish, variegated with reddish brown, the color sometimes in short, revolving blotches and sometimes in irregular longitudinal streaks. Inside the shell is usually pale brownish, with a white border on the inside of the lip.

Length, 55; diameter, 30 mm.

Mayaguez, three shells. A common form in the West Indian region and on the Florida Keys.

Purpura trinitatensis Guppy.

Purpura trinitatensis Guppy, Proc. Sci. Assoc. Trinidad, 1869; Ann. Mag. Nat. Hist., 4th ser., XV, p. 50, 1875.

Caballo Blanco Reef, one specimen; also Trinidad and the northern coast of Brazil.

This has the colors of *P. undata*, but with a much more solid and shorter shell, strongly sixdenticulate on the outer lip, the pillar with an obscure median fold, as in *P. columellaris*, but the pillar not excavated externally; the base of the pillar obliquely striate and brown tinted, most of the mouth callus white or purple brown. It recalls *P. deltoidea* in form and solidity, but has a differently colored and sculptured aperture.

Purpura deltoidea Lamarck.

Purpura deltoidea Lamarck, An. sans. Vert., VII, p. 247, 1822.
Purpura deltoidea Reeve, Conch. Icon., III, pl. IV, fig. 18, 1846.

Shell solid, short, with a single row of strong tubercles on the whorls, which forms a shoulder; sculptured throughout with revolving lirae and fine grooves; aperture whitish, purple stained on the columella. Color white, with broad, irregular, broken, black bands.

Length, 45; diameter, 35 mm.

Aguadilla; Hucares; Puerto Real; San Juan; Guanica; Hucares; Cabo Rojo light, Porto Rico; Ensenada Honda, Culebra; Caballo Blanco Reef, Vieques. Abundant throughout the West Indian region and the Florida Keys.

Genus SISTRUM Montfort, 1810.

Shell oval, thick, tuberculous or spinose; aperture oblong, canaliculate above; outer lip furnished with strong teeth within; columella with slight plications. Operculum oval, straight, with lateral nucleus.

Sistrum nodulosum C. B. Adams.

Purpura nodulosa C. B. Adams, Proc. Bost. Soc. Nat. Hist., 1845, p. 2.
Ricinula nodulosa Tryon, Man., II, p. 190, pl. LIX, fig. 275, 1880.

Shell rather elongated, with about eight whorls, with ten or twelve longitudinal ribs, which are broken by revolving ridges into strong nodules; surface covered with fine, revolving, sometimes scaly threads; outer lip thickened and varicose, with four whitish teeth within; columella with two or three faint folds on its face, and there is a strong angular callus on the upper part of the parietal wall. Color black, with occasional white spots between the tubercles; the white spots sometimes form broken bands; aperture bluish and blackish within.

Length, 20; diameter, 9 mm.

Cabo Rojo light; Ponce Reefs; San Juan; Puerto Real; Porto Rico; Ensenada Honda, Culebra; West Indies, etc.

Family CORALLIOPHILIDÆ.

Genus CORALLIOPHILA H. & A. Adams, 1853.

Shell irregular, purpuriform, with a short spire; aperture large; surface rasp-like; outer lip simple, lirate, or smooth within; columella flat or excavated, callous, with or without an umbilical opening at its base. Operculum with a lateral nucleus.

Coralliophila abbreviata Lamarck.

Pyrula abbreviata Lamarck, Enc. Méth. pl. ccccxxxv, fig. 2 *a–b*, 1795; An. sans. Vert., VII, p. 146, 1822.

Shell solid, variable in form and sculpture, generally with a ridge on the upper whorls, which may be somewhat sharp or rounded, and which makes the body whorl shouldered, with or without low longitudinal ribs; spire generally rather short; surface sculptured with fine, rather sharp, sometimes scaly revolving ribs; outer lip somewhat lirate within; canal short. There is generally a decided umbilicus, having a sharp ridge to the left of it. Color whitish, flesh color, or yellowish, the interior often purple.

Length, 30; diameter, 22 mm.

Mayaguez; Playa de Ponce, Porto Rico; Vieques, young and worn shells.

This species is widely distributed in warm seas. The young shells are generally more attenuated, sharper keeled, and more strongly ribbed than adult specimens. It is commonly known under the name of *Coralliophila galea*.

Superfamily STREPTODONTA.

Family SCALIDÆ.

Genus SCALA (Humphrey, 1797) Auct.

Shell turriculated, rather solid, shining, generally more or less umbilicated; spire elongated; whorls numerous, rounded, in contact or partially separated, with numerous longitudinal varices; aperture circular; peristome entire reflected; operculum horny, spiral, its nucleus nearly central.

Scala angulata Say.

Scala clathrus var. *angulata* Say, Am. Conch., III, pl. XXVII, 1831.

Shell white, shining, with from six to eleven whorls, which approach each other very closely, but touch only by the varical ribs, which number nine to eleven, slightly recurved, simple, slightly angulated above near the suture; aperture elliptic; base a little angular.

Length, 15 to 20; diameter, 6 to 8 mm.

Arroyo, Porto Rico, one young shell; Ensenada Honda, Culebra.

Scala turricula Sowerby.

Scalaria turricula Sowerby, Thes. Conch., No. 37, fig. 62, 1847.

Shell rather slender, with the whorls scarcely touching, slightly umbilicated, covered with very fine spiral striations, with twelve or thirteen ribs to each whorl; part of ribs thin, others thicker, some rounded above, others shouldered or hooked; surface dull, with faint brownish tints.

Length, 18; diameter, 8 mm.

Mayaguez, one young shell.

Scala unifasciata Sowerby.

Scalaria unifasciata Sowerby, Thes. Conch., I, pl. XXXIII, fig. 68, 1847.

Quebradillas, Porto Rico (Gundlach).

Scala eulita, n. sp. Plate 57, fig. 2.

Shell small, very slender, white, polished, with nine whorls, nepionic part three-whorled, compact, white, without varices; subsequent whorls convex, smooth, with (on the ninth) about fifteen varices, which are very thin, sharp, and when perfect show a small angle near the suture; whorls adjacent, with no basal cord or disk.

Length, 4; maximum diameter, 1.2 mm.

Mayaguez Harbor, Porto Rico, one specimen.

The shell is remarkable for its acicular form and small size. The specimen is somewhat defective, and the figure hardly shows the little angular projection near the suture, which is normal to the varices.

Subgenus ACRILLA Adams, 1860.

Surface reticulated; shell thin.

Scala retifera Dall.

Scala (*Acrilla*) *retifera* Dall, Blake Report, Gastropoda, p. 312, 1889; Bull. 37, U. S. Nat. Mus., p. 124, 1889.

Mayaguez, Porto Rico, at station 6062, one specimen; also north to Cape Hatteras, North Carolina.

Superfamily GYMNOGLOSSA.

Family EULIMIDÆ.

Genus EULIMA Risso, 1826.

Section EULIMA s. s.

Shell imperforate, subulate, with many flat whorls, polished; spire often turned to one side, obscurely marked down one side with a series of traces of varices, which form ribs internally; aperture oval, pointed above; lip simple or slightly thickened; operculum horny, paucispiral; nucleus excentric.

Eulima oleacea Kurtz & Stimpson.

Eulima oleacea Kurtz & Stimpson, Proc. Bost. Soc. Nat. Hist., IV, p. 115, 1851.
Eulima intermedia Jeffreys, Brit. Conch., IV, p. 103, V, p. 214, pl. LXXVII, fig. 4.

Shell small, rather narrow, nearly straight, with eleven or twelve flat whorls; suture very faintly marked; aperture ovate, sharp above; lip well produced in the middle; columella slightly reflected, produced into a callus on the parietal wall. Color milky white, with a semitransparent band at the suture, glossy.

Length, 5; diameter, 1.25 mm.

Mayaguez, two shells and a fragment.

Eulima conoidea Kurtz & Stimpson.

Eulima conoidea Kurtz & Stimpson, Proc. Bost. Soc. Nat. Hist., IV, p. 115, 1851.
Eulima conoidea Tryon, Man., VIII, p. 273, pl. LXIX, fig. 40, 1886.

Shell with twelve or thirteen slightly rounded whorls, nearly straight, moderately stout; last whorl sometimes faintly subangulate at the base; outer lip scarcely thickened, well advanced in the middle; aperture subrhomboid. Color shining white, the upper whorls sometimes flesh-colored.

Length, 8; diameter, 2 mm.

Puerto Real; Mayaguez, Porto Rico; three shells.

Subgenus LEIOSTRACA H. & A. Adams, 1853.

Shell slender, polished, often ornamented with spiral colored bands, with a succession of slight varices on each side of the spire, not always apparent; aperture long, narrow.

Eulima patula n. sp. Plate 57, fig. 3.

Shell small, translucent white, with a rapidly diminishing spire, blunt at the extreme tip, but otherwise acute, the sides nearly rectilinear or even slightly concave; whorls about nine, the earliest ones slightly inflated; last whorl much the largest, the aperture large, pillar straight, outer lip nearly straight and, as it were, slightly pressed in at the periphery; the anterior part of the aperture very patulous.

Length, 4.5; maximum diameter, 1.5 mm.

Station 6062, Mayaguez Harbor, Porto Rico, five specimens.

Eulima acuta Sowerby.

Eulima acuta Sowerby, P. Z. S., 1834, p. 8.
Eulima acuta Tryon, Man., VIII, p. 280, pl. LXX, fig. 82, 1886.

Shell slender, straight, with about ten flat whorls, the suture barely discernible as a line; aperture long-ovate, slightly patulous; outer lip scarcely thickened, not advanced in the middle. Color white, sometimes showing one or two pale yellow bands.

Length, 5; diameter, 1 mm.

Mayaguez, Porto Rico, a half dozen specimens.

Genus NISO Risso, 1826.

Shell deeply umbilicated, long-conical, polished, many-whorled, the apex very sharp; whorls nearly flat; aperture oval, pointed above, somewhat drawn out below; lip thin; operculum as in *Eulima*.

Niso portoricensis, n. sp. Plate 57, fig. 4.

Shell small, brilliantly polished, with about thirteen whorls; sides rectilinear, base rounded, apex acute; umbilicus deep, funicular, the umbilical side of the whorls convex, the umbilical carina distinct but not sulcating the aperture; apex and upper part of the whorls brown, intensified at the lines marking the periodical resting stages. At the periphery is a narrow pale zone, while the base is brown under a whitish superficies; peripheral angle not sharp, the whorls microscopically sharply axially striate with rather distinct fine grooves.

Length, 9; diameter, 3.5 mm.

Station 6062, Mayaguez Harbor, Porto Rico.

This elegant shell is nearest to *N. æglees* Bush, but has a different system of coloration.

Family PYRAMIDELLIDÆ.

Genus PYRAMIDELLA Lamarck, 1799.

Shell with elevated, sharp-pointed spire, many-whorled, smooth; aperture suboval, entire, rounded in front; columella straight, with prominent spiral plications; operculum horny, semicircular, subspiral, the nucleus at the front end, its columellar edge notched to fit the folds of the columella.

Pyramidella subdolabrata Mörch.

Obeliscus subdolabratus Mörch, Mal. Blätt., XXII, p. 157; A. Adams, Thes. Conch., Pyramidella, p. 805, pl. CLXXI, figs. 1–3, 1854.

Shell of rather light structure, with about thirteen rounded whorls, which are narrowly shouldered below the suture; last whorl slightly ascending; surface apparently smooth, but seen to have fine, revolving sculpture under a lens, and this being crossed by the growth lines makes it faintly reticulate; aperture long-oval; outer lip slightly thickened, not toothed within; columella with a strong, sharp fold above, the two lower folds feebly developed; umbilicus narrow, deep. Color brownish white, with about three brown, revolving bands on the body whorl and two on the upper whorls; besides these there is a brown patch or band around the umbilicus.

Length, 30; diameter, 13 mm.

Fajardo, Porto Rico, one very fine shell.

This species has been mistaken for the *P. dolabrata* of Linnæus, but it has a duller color, lighter structure, and less strongly developed columella folds than that species. The bands of color are wider and less distinct than in *dolabrata*, and the reticulation of the surface is stronger.

Genus TURBONILLA Risso, 1826.

Shell slender, straight, many-whorled; whorls slightly convex, generally costulate; aperture simple, oval or subquadrangular; columella straight; lip thin; operculum having a spiral groove at its columellar border.

?**Turbonilla reticulata** C. B. Adams.

? *Chemnitzia reticulata* C. B. Adams, Contr., 1850, p. 75.

A fragment of a badly worn shell was obtained from dredgings taken at Mayaguez, which is probably this species.

Section PYRGISCUS Philippi, 1841.

Turbonilla portoricana, n. sp. Plate 53, fig. 15.

Shell of medium size, moderately stout, of almost rectilinear outline, translucent, with a narrow yellowish or brownish-yellow spiral band around the whorls about one-fourth the breadth of the whorl above its suture, and a second very pale one, which is almost obsolete, of about the same width on the middle of the base, which is best seen within the aperture by transmitted light; nuclear whorls two and one-half, helicoid, somewhat oblique, moderately prominent; the periphery of the last whorl projecting but slightly beyond the outline of the first post-nuclear whorl, not immersed but surmounting the later whorls, their axis being almost at right angles to the axis of the post-nuclear whorls. Post-nuclear whorls ten, flattened, slightly contracted at the sutures, traversed by strong, regular, more or less vertical, axial ribs, of which about fourteen appear upon the second, eighteen upon the fifth, twenty upon the seventh, and twenty-six upon the ninth whorls; these ribs pass almost undiminished in size over the periphery and base of the last whorl to the umbilical region. Intercostal spaces ornamented by six equally spaced, deep, broad spiral striations, which extend partly up on the sides of the ribs, but do not reach or cross their summits. Base similarly ornamented with six spiral striations which are.placed much closer. Aperture subovate, somewhat effuse at the junction of the oblique, slightly revolute columella with the strongly curved outer lip, which meet almost at right angles; a well-marked callus covers the parietal wall within the aperture and connects the outer lip at the posterior angle with the columella. Columella provided with a quite prominent oblique fold near its insertion; outer lip pellucid, showing the external sculpture and color bands within.

Length, 4.7; length of spire, 4.3; diameter, 1.2 mm.

The type and three specimens are in every respect identical and are from Mayaguez, Porto Rico.

Turbonilla insularis, n. sp. Plate 53, fig. 21.

Shell of medium size, moderately stout, of almost rectilinear outline, milk white, with the upper whorls stained dusky. Nuclear whorls decollated; a small portion only remains, whose size would indicate a rather large nucleus. Post-nuclear whorls thirteen, very slightly convex, almost flattened, with about sixteen prominent more or less vertical, axial ribs on the fifth, eighteen on the tenth, twenty on the eleventh, and twenty-eight on the twelfth whorl, which pass over the well-rounded periphery of the last whorl, becoming feebler upon its base, finally vanishing just before reaching the umbilical region. Intercostal spaces broad and undulating, rather more than double the width of the ribs, except upon the twelfth whorl, which has a decided increase in the number of ribs and a consequent diminution in the breadth of the intercostal spaces; these spaces are traversed by about eleven quite regularly spaced, deep, spiral striations on the fifth whorl and twelve upon the succeeding volutions, where there is a tendency toward further division of the spaces between these striations by an occasional intercalation of a less pronounced line; these spiral lines do not pass over the axial ribs, but are confined to the troughs of the intercostal areas. Base traversed by about eight faint, reddish, wavy, spiral lines. Sutures well defined, rendered crenulate by the prominent summits of the ribs. Aperture irregularly rhomboidal, showing the external sculpture within. Outer lip gently curved, somewhat effuse at its junction with the twisted, oblique, and revolute columella.

Length, 7.1; length of spire, 6.4; diameter, 1.8 mm.

Locality, Mayaguez, Porto Rico.

Superfamily **NUCLEOBRANCHIATA.**

Family ATLANTIDÆ.

Genus ATLANTA Lesueur, 1817.

Shell fragile, transparent, discoidal, compressed, with a prominent carina; nucleus dextral; aperture oval, straight, deeply sulcate above at the carina; operculum subtriangular, bearing an apical nucleus.

Atlanta peronii Lesueur.

Atlanta peronii Lesueur, Journ. de Phys., LXXXV, pl. II, fig. 1, p. 390, 1817.

Shell discoidal, with numerous earlier whorls, which are elevated into a low spire on the upper side; later whorls openly coiled but connected by the carina; carina strong, obliquely striate; surface with delicate growth lines, glassy.

Greatest diameter, 12; of aperture, 5; lesser diameter of aperture, 3 mm.

Aguadilla; Boqueron Bay, Porto Rico; one shell from each locality; widely distributed.

Superfamily TÆNIOGLOSSA.

Family SEPTIDÆ.

Genus DISTORTRIX Link, 1807.

Shell subturriculated, with cancellated sculpture; whorls irregularly turned and distorted; last whorl ascending the spire; outer lip wide and flattened; inner lip developed into a broad callus, which extends well up on the spire and to the base of the shell, showing the cancellated sculpture; the remains of these calluses and the outer lip form varices on the shell; aperture grimaced, the lip strongly toothed within; columella strongly curved, somewhat S-shaped, the lower part toothed; canal reflexed.

Distortrix reticulata Link.

Distortrix reticulata Link, Beschr. Rostock Samml., III, p. 122, 1807.
Triton clathratum Lamarck, An. sans Vert., VII, p. 186, 1822; Enc. Méth., pl. 413, fig. 4.

Shell covered with a pale epidermis, sometimes having bristly hairs on the ribs; varices faint and appressed, showing the groove behind the former lip; surface cancellated by rather delicate longitudinal ribs crossed by revolving ridges; callus (including the lip) triangular; outer lip finely toothed within, with a few stronger teeth above; canal somewhat lengthened, slightly reflexed, whitish or brownish, the lip and callus whitish or buff color, sometimes a little variegated.

Length, 80; diameter, 40 mm.

Mayaguez.

Distortrix reticulata var. clathrata Dall.

Distortrix var. *clathrata* (Lam.) Dall, Blake Report, p. 222, 1889.

Two very young, somewhat worn shells were dredged at Mayaguez, which may be this variety.

Genus GYRINEUM Link, 1807.

Shell oval or oblong, compressed, nodulous, with two rows of varices opposite each other; aperture oval or elliptical, with a sulcus above; outer lip toothed, inner lip wrinkled; basal canal short, generally reflexed; operculum horny.

Gyrineum cruentatum Reeve.

Ranella cruentata Reeve, Conch. Icon., II, pl. V, fig. 20, 1844.

Shell short, solid, with revolving tubercled ridges, that on the periphery being strongest, the one immediately below it quite prominent; below the suture there are faint, irregular plications; upper canal small, not carried much upward; aperture elliptical, the inner lip with scattered plications; canal slightly reflexed. Color whitish, irregularly spotted and blotched with reddish brown; aperture white or purple, often with reddish maculations between the plicæ on the parietal wall.

Length, 40; diameter, 30 mm.

One young specimen with purple aperture was obtained at Mayaguez Harbor.

Genus SEPTA Perry, 1811.

Shell oval, oblong or elongated, solid, furnished with scattered varices; outer lip thickened, toothed within; columella with numerous plications; canal long or short.

It is *Triton* Montfort, 1810, not Linnæus, 1758; and *Tritonium* Cuvier, 1817, not Müller, 1776.

Septa tritonis var. nobilis Conrad.

Triton nobilis Conrad, Journ. Acad. Nat. Sci. Phila., 2d ser., I, p. 212, 1849.
Triton variegatus var. Reeve, Conch. Icon., II, pl. I, fig. 3a, 1844.

Porto Rico, various localities (Gundlach).

The variety *nobilis* is a shorter, heavier, more shouldered form than the type, which comes from the Indo-Pacific region.

Genus COLUBRARIA Schumacher, 1817.

Shell elongated, axis usually arcuate; aperture small; canal short.

Colubraria lanceolata Menke.

Ranella lanceolata Menke, Syn., p. 87, 1828.
Triton lanceolatus Reeve, Conch. Icon., II, pl. XVIII, fig. 79, 1844.

San Juan, Porto Rico (Gundlach).

Genus RANULARIA Schumacher, 1817.

Shell pyriform; spire short; canal long, straight or curved.

Ranularia tuberosa Lamarck.

Triton tuberosum Lamarck, An. sans Vert., VII, p. 185, 1822.
Triton antillarum d'Orbigny, Moll. Cubana, II, p. 161, pl. XXIII, fig. 20, 1845.

Shell rather short, with a moderate spire and recurved canal; whorls slightly rounded, the last ascending, sculptured with irregular, nodulous ribs, which are lirate in the interstices and are somewhat longitudinally plicate at the upper part of the shell and wrinkled below; there is often a strong hump on the back of the body whorl and one or two minor humps; outer lip varicose, toothed within; inner lip spreading in a wide callus over the base of the shell. Color dirty white, faintly marked with brown, sometimes brown banded; aperture white, rich reddish brown within.

Length, 55; diameter, 30; length of canal, 18 mm.

Mayaguez, Porto Rico; Ensenada Honda, Vieques, young shells; Indo-Pacific and West Indian regions.

Genus LAMPUSIA Schumacher, 1817.

Lampusia pilearis Lamarck.

Triton pileare Lamarck, An. sans Vert., VII, p. 82, 1822.
Triton pileare Kiener, Icon. Coq. Viv., p. 15, pl. VII, fig. 1.

Shell with somewhat rounded whorls, which are often irregularly turned, sometimes with a row of nodules on the periphery, sculptured with finer and coarser revolving ridges, which are crossed by rather faint longitudinal ribs; outer lip heavy, toothed or strongly ridged within; columellar area strongly wrinkled, ridged; canal moderate, usually reflexed. Color tawny to dark brown, usually more or less white banded, sometimes having longitudinal dark flames; aperture varying from tawny to deep red or red brown, the teeth and folds whitish. The ground of the upper part of the inner lip is often blackish.

Length, 130; diameter, 55 mm.

Mayaguez Harbor; San Juan, Arroyo, Porto Rico.

An abundant and variable species distributed throughout the West Indian and Indo-Pacific regions.

Lampusia chlorostoma Lamarck.

Triton chlorostomum Lamarck, An. sans. Vert., VII, p. 185, 1822.
Triton chlorostomum Kiener, Icon. Coq. Viv., p. 19, pl. XII, fig. 2.

Shell with shouldered, often irregularly turned whorls, with sculpture much like that of *T. pileare*, but with stronger, more nodulous longitudinal ribs, often decidedly humped behind on the body whorl; varices strong; outer lip very heavy; aperture small, usually with a double row of teeth within; inner lip wrinkled, plaited; canal moderate, recurved. Color dirty white to reddish ash, faintly variegated with brown, the aperture reddish.

Length, 90; diameter, 40 mm.

Arroyo; Ponce Reefs; Mayaguez; San Juan, Porto Rico; West Indian and Indo-Pacific regions.

Another abundant and variable species, with a distribution over the same area as the last. It has a more distinctly angled shoulder, heavier varices, stronger longitudinal knobbed ridges, and a smaller aperture than the *T. pileare*, though the two have many characters in common.

Lampusia cynocephala Lamarck.

Triton cynocephalum Lamarck, An. sans Vert., VII, p. 184, 1822.
Triton cynocephalus Reeve, Conch. Icon., II, pl. VIII, fig. 26, 1844.

Quebradillas; San Juan, Porto Rico (Gundlach); West Indies; Indo-Pacific region.

Genus LOTORIUM Montfort, 1810.

Lotorium femorale Linnæus.

Murex femorale Linnæus, Syst. Nat., ed. X, p. 749, 1758.
Triton femorale Reeve, Conch. Icon., II, pl. VII, fig. 22, 1844.

Mayaguez; Quebradillas; San Juan, Porto Rico (Gundlach).

Family CASSIDIDÆ.

Genus CASSIS Lamarck, 1799.

Shell ovoid, inflated, generally bearing irregular varices; spire moderate to low; aperture elongated, the outer lip reflected and denticulated within; columella callous, wrinkled or nodulous; canal short, very sharply recurved; operculum elongate or semilunar; nucleus lateral and median.

Subgenus CASSIS s. s.

Cassis tuberosa Linnæus.

Buccinum tuberosum Linnæus, Syst. Nat., ed. x, p. 735, 1758.
Cassis tuberosa Reeve, Conch. Icon., v, pl. III, fig. 7, 1848.

Mayaguez, Porto Rico (Gundlach).

Cassis flammea Linnæus.

Buccinum flammeum Linnæus, Syst. Nat., ed. x, p. 736, 1758.
Cassis flammea Reeve, Conch. Icon., v, pl. v, fig. 12, 1848.

San Juan, Porto Rico (Gundlach).

Subgenus CYPRÆCASSIS Stutchbury, 1837.

Spire short; aperture straight; varices reduced or wanting; no operculum.

Cassis testiculus Linnæus

Buccinum testiculus Linnæus, Syst. Nat., ed. x, p. 736, 1758.
Cassis testiculus Reeve, Conch. Icon., v, pl. IV, fig. 10, 1848.

Shell obovate, with low spire and rounded shoulder, covered with narrow longitudinal ribs, which are more or less broken by shallow, wide, distant, revolving furrows. Besides this the whole surface is covered with microscopic revolving threads; outer lip thick, reflexed, toothed within; there are often one or more faint varices on the body whorl; parietal wall covered with a heavy callus, which extends well over the base of the shell; columella wrinkled. Color pale reddish or rosy brown, with dark squarish or lunate blotches on the revolving ridges; outer lip white, with buff bands across it, which become blackish on its back.

Length, 60; diameter, 40 mm.

San Juan, Porto Rico, one fine young shell.

Subgenus SEMICASSIS Mörch, 1852.

Spire rather prominent; whorls with spiral sculpture; aperture large; lip reflexed, plicate; columella plicate and nodulous.

Cassis inflata Shaw.

Cassis inflata Shaw, Nat. Misc., vol. XXII, pl. 959, 1812.

Shell rather short, solid, scarcely obovate, with a moderate, sharp spire, the whorls of which are hardly rounded, the sculpture consisting of narrow, rather distant, revolving grooves crossed by more or less developed longitudinal ribs, making the spire and sometimes the body whorl cancellated. Outer lip thick, reflexed and becoming very heavy with age, strongly ridged within; columellar callus strong, granulate without; plicate within. Color purplish or bluish white, sometimes tinted brownish, with revolving rows of darker square spots.

Length, 60; diameter, 40 mm.

One young shell was taken at Mayaguez.

In general the specimens found along the shore are dead and bleached to a uniform white.

Genus SCONSIA Gray, 1847.

Shell elongate oval, with revolving striæ, bearing a single varix opposite the outer lip; canal short, slightly reflected; inner and outer lips plicate.

Sconsia striata Lamarck.

Cassidaria striata Lamarck, An. sans Vert., VII, p. 216, 1822.
Cassidaria striata Reeve, Conch. Icon., V, pl. I, fig. 2, 1849.

Shell solid ovate, closely, spirally striate, made somewhat decussate by distinct growth lines; suture deep; aperture rather elongated; inner and outer lips strongly plicate, the latter thickened within; canal somewhat developed, but slightly reflexed; columellar callus thick, extending well over the base. Color whitish, with rows of square brown spots.

Length, 45; diameter, 25; of aperture and canal, 35 mm.

Mayaguez Harbor, one very young and one partly grown shell in bad condition.

The above measurements are taken from a fine, perfectly fresh shell in the National Museum collection.

Genus LAMBIDIUM Link, 1808.

Shell solid, subconical, covered with revolving rows of strong, warty nodules; spire varying from low to moderate; outer lip decidedly thickened, dentate within; canal short, scarcely recurved; columellar callus extending over the base of the shell, nodulous.

Lambidium oniscus Linnæus.

Strombus oniscus Linnæus, Syst. Nat., ed. XII, p. 1210, 1767.
Oniscia oniscus Reeve, Conch. Icon., V, pl. I, fig. 1, 1849.

Shell obconic, with low spire, its whorls having a rather sharp shoulder which is sometimes nearly smooth, at others sculptured with revolving striæ, and often nodulous; on the body whorl are 3 revolving rows of strong tubercles; outer lip thickened, slightly ascending the spire, swollen within and without, toothed, sometimes cut away below; columellar callus strong, finely pustulous. Color whitish, variegated with brownish or dark gray, outer lip dotted; aperture white; callus white or purplish.

Length, 23; diameter, 15; length of aperture, 23; greatest width of aperture, 2.5 mm.

Hucares; Guanica; Aguadilla; Ponce, Porto Rico; Ensenada Honda, Culebra.

Family DOLIIDÆ.

Genus DOLIUM Lamarck, 1801.

Shell large, thin, inflated, globular; spire short; whorls spirally sculptured; aperture very large; lip toothed and ridged internally; columellar callus reflexed; basal notch oblique, large.

Dolium perdix Linnæus.

Buccinum perdix Linnæus, Syst. Nat., ed. X, p. 734, 1758.
Dolium perdix Reeve, Conch. Icon., V, pl. VI, fig. 9, 1849.

Shell somewhat oval, with rather elevated spire, the whorls being rounded; suture deep; surface sculptured with narrow revolving grooves, which are generally rather widely spaced and with faint, revolving striæ; this is sometimes reticulated by the growth lines; outer lip scarcely thickened, basal notch shallow, wide; behind the reflexed curved columella there is an umbilicus. Color brownish or purple brown, the grooves often whitish and the ridges marked across with lunar white markings. Sometimes it is only faintly marked with white spots.

Length, 160; diameter, 110 mm.

Arroyo; San Geronimo, Porto Rico, one worn and broken shell from each locality; West Indian and Indo-Pacific regions generally.

Dolium galea Linnæus.

Buccinum galea Linnæus, Syst. Nat., ed. X, p. 734, 1758.
Dolium galea Reeve, Conch. Icon., V, pl. I, 1848.

Shell nearly globular, with sharp-pointed spire rising but little above rounded outline; whorls rounded, sculptured with distant revolving grooves; suture deep; outer lip a little thickened, crenate on its edge, showing the ridges and grooves within; basal notch moderate; there is an umbilicus behind columellar reflection. Color whitish or fulvous, spire darker; columellar area with brown stains,

Length, 200; diameter, 160 mm.

Mayaguez, one young specimen; West Indies and Mediterranean,

Family AMPHIPERASIDÆ.

Genus ULTIMUS Montfort, 1810.

Shell solid, elongate-elliptical, the narrow aperture running its entire length; aperture edentulous, or nearly so; there is a strong, elevated, blunt ridge running across the back of the shell.

Ultimus gibbosus Linnæus.

Bulla gibbosa Linnæus, Syst. Nat., ed. x, p. 726, 1758.
Ovulum gibbosum Reeve, Conch. Icon., xv, pl. vii, fig. 32, 1865.

Shell solid, narrower above; spire enrolled with the shell and completely concealed under a heavy callus; aperture reaching the entire length of the shell, narrow above, somewhat widened below; outer lip thickened, smooth within and without, arched over the upper end of the shell, where it is slightly canaliculate; dorsal ridge high and strong, placed a little above the center of the shell and running squarely across it; base somewhat canaliculate, the smooth, thick columella slightly truncated below. Color whitish, the sides and ends rich cream or buff color.

Length, 25; diameter, 14 mm.

Aguadilla; Mayaguez Harbor, Porto Rico; also West Indian region, Florida Keys, etc.

Family CYPRÆIDÆ.

Genus CYPRÆA Linnæus, 1758.

Shell ovoid, inflated, enrolled, covered with brilliant enamel; spire concealed by the last whorl, or very short and covered with enamel; aperture elongated, narrow, furnished with a short canal at each end; lip inflected and, with the columellar border, dentate.

Cypræa exanthema Linnæus.

Cypræa exanthema Linnæus, Syst. Nat., ed. xii, p. 1172, 1767.
Cypræa exanthema Reeve, Conch. Icon., iii, pl. v, fig. 16, 1848.

Shell rather elongated, subcylindrical; aperture slightly curved, a little wider below; inner and outer lips well raised above the spire, and separated above by a rounded canal; below, the outer lip and columella project each in a flattened process, with a short, open canal between; teeth moderately strong, very dark brown. Color pale chocolate, varying to tawny on the back, with numerous rather large, round, whitish spots. The meeting line of the lobes of the mantle is whitish and straight.

Length, 100; diameter, 50 mm.

A single specimen in very bad condition, without locality, was obtained by the *Fish Hawk* expedition.

A variable species, which probably includes the *Cypræa cervus* of Linnæus, a larger, more inflated shell, with smaller spots. The latter is reported from Porto Rico by Gundlach.

Cypræa cinerea Gmelin.

Cypræa cinerea Gmelin, Syst. Nat., p. 3404, 1792.
Cypræa cinerea Reeve, Conch. Icon., iii, pl. xxii, fig. 124, 1846.

Shell somewhat obovate, ventricose, inner and outer lips not greatly elevated above; teeth short, moderate; back ashy brown, with two faint lighter bands, and often sprinkled with black dots; sides and base purplish flesh-colored; interstices between the teeth purplish.

Length, 35; diameter, 20 mm.

Mayaguez Harbor; Aguadilla, Porto Rico; several badly worn shells.

Cypræa spurca Linnæus.

Cypræa spurca Linnæus, Syst. Nat., ed. x, p. 724, 1758.
Cypræa spurca Reeve, Conch. Icon., iii, pl. xiv, fig. 68, 1845.

Shell obovate, more or less inflated; lips not greatly produced above; aperture slightly curved, a very little wider below; teeth rather strong, short; sides pitted; back whitish or buff, clouded and mottled with fulvous yellow, the pits and sides often spotted with brown.

Length, 30; diameter, 18 mm.

Aguadilla, Porto Rico, six worn shells.

These specimens are probably the variety *flaveola* Lamarck, but are too much worn to be identified with certainty.

Family TRIVIIDÆ.

Genus TRIVIA Gray, 1832.

Shell generally small, oval or obovate, inflated, enrolled, transversely grooved and ridged above and below, with a longitudinal dorsal furrow, scarcely shining; aperture long, narrow, scarcely canaliculate above or below. Anatomy very distinct from that of *Cypræa*.

Trivia pediculus Linnæus.

Cypræa pediculus Linnæus, Syst. Nat., ed. x, p. 724, 1758.
Cypræa pediculus Reeve, Conch. Icon., III, pl. XXIII, fig. 131, 1846.

Shell rather solid, obovate, inflated, with a deep, straight, longitudinal, dorsal furrow, from which strong, subradial ridges run over the shell and extend into the aperture; these are subnodulous at the dorsal furrow; inner and outer lips thickened somewhat around the base; the space between the ridges above and below is faintly wrinkled and nodulous. Color purplish brown, with a dark spot at each end of the dorsal furrow and another on each side of it at the middle; these spots vary much in shape; the base is smoky tinted.

Length, 15; diameter, 11 mm.

Aguadilla, Porto Rico, several fine shells; West Indies; Florida.

Trivia quadripunctata Gray.

Trivia quadripunctata Gray, Zool. Journ., III, p. 368, 1827.
Cypræa quadripunctata Reeve, Conch. Icon., III, pl. XXV, fig. 146, 1846.

Shell small, obovate, slightly elongated; dorsal groove well marked; transverse ridges fine, slightly nodulous near the groove, with numerous intermediate ones which only reach part way up the back; outer lip thickened. Color purplish pink, often tinted darker on the extremities; on each side of the dorsal groove there are two darker spots, and these four spots form a zigzag row.

Length, 8; diameter, 5 mm.

Aguadilla, Porto Rico, one shell.

Trivia quadripunctata var. **rotunda** Kiener.

Cypræa rotunda Kiener, Coq. Viv., p. 141, pl. LIII, fig. 2.

More globose than the type. Mayaguez, Porto Rico, two shells.

Genus ERATO Risso, 1826.

Shell small, subpyriform or suboval, polished; spire always visible, conical; last whorl large; aperture nearly straight, narrow, nearly as long as the shell; outer lip thick, thicker in the middle, toothed within; columellar area sometimes toothed or plicate; base notched.

Erato maugeriæ Gray.

Erato maugeriæ Gray, in Sowerby, Conch. Illustr., p. 17, pl. VII, fig. 47, 1832.
Erato maugeriæ Tryon, Man., V, p. 9, pl. IV, figs. 42, 43, 1883.

Shell small, pyriform, with a moderate spire and flattened whorls; aperture narrow, long, nearly straight, and not spread below; the lip much thickened, slightly ascending the spire and heaviest in the middle, faintly toothed within; columellar area smooth, feebly plicate at base; canal somewhat drawn out, truncate. Color gray or livid, often tinted green, the lip whitish.

Length, 5; diameter, 3.5 mm.

Mayaguez, Porto Rico, two worn shells; West Indies; Florida.

Family STROMBIDÆ.

Subfamily STROMBINÆ.

Genus STROMBUS Linnæus, 1758.

Shell ovoid, smooth, tuberculous or spinous, imperforate, solid, covered with an epidermis; spire with numerous whorls, elevated; aperture long, with a notch at the base and one on the outer lip above the base, somewhat canaliculate above; lip thickened, dilated; columellar border simple, enameled; operculum unguiculate, its edge roughened or toothed.

Strombus gigas Linnæus.

Strombus gigas Linnæus, Syst. Nat., ed. x, p. 745, 1758.
Strombus gigas Reeve, Conch. Icon., vi, pl. ii, fig. 2, 1850.

Shell with about twelve whorls, which are concave on the spire, being furnished with a ridge near the base that on the later ones becomes nodulous, the nodules of the last two whorls strong and spiked; the surface has faint, revolving sculpture, which sometimes develops into low, indistinct ridges on body whorl; outer lip greatly expanded, rising above into a rounded or somewhat pointed wing as high as or higher than the spire; lip notch large, near base; basal notch wide. The shell is covered with a horn-colored epidermis which often peels and falls off; the shell is buff-colored to tawny; outer lip pale pink, becoming deep pink within the aperture; columella and parietal wall rich pink.

Length, 25; diameter, 20 cm.

Arroyo; San Antonio Bridge, San Juan; Ponce Reefs, Porto Rico; Ensenada Honda, Culebra, many young.

A magnificent shell. The animal is used extensively for food throughout the West Indian region, and the shells are manufactured into cameos and sometimes produce valuable pearls.

Strombus pugilis Linnæus.

Strombus pugilis Linnæus, Syst. Nat., ed. x, p. 744, 1758.
Strombus pugilis Reeve, Conch. Icon., vi, pl. xvi, figs. 39–41, 1851.

Shell with about eleven whorls, which are sculptured with revolving threads on the spire and the base of the body whorl; earlier whorls with fine, longitudinal ribs, which generally develop into nodules later, and into spines on the last two whorls; outer lip slightly thickened, winged and projecting forward above, widely spread, with an open canal next to the spire, notched below somewhat above the base, the base also notched, the shell being very thin at this part; columellar callus covering the base of the shell. The shell is covered with a rather thick epidermis, under which it is brownish, reddish, orange, or straw colored, the aperture and base being brilliantly colored.

Length, 80; diameter, 55 mm.

Mayaguez; Playa de Ponce; Boqueron Bay, Porto Rico.

An abundant and variable species, which is sometimes destitute of spines, and this form Gmelin called *S. alatus*. In most of the West Indian forms the spines stand at right angles to the axis of the shell. In a majority of the Floridian specimens they are less developed and point upward. Occasionally the shell is straw colored or nearly white within; in some of the Floridian shells the interior is blue purple, and without it is sometimes variegated with zigzag lines.

Specimens tend, in the West Indies, toward a smaller size, more prominent spines, and a pale salmon-pink tint, the more southern and eastern the locality from which they come.

Strombus costatus Gmelin.

Strombus costatus Gmelin, Syst. Nat., p. 3520, 1792.
Strombus accipitrinus Reeve, Conch. Icon., vi, pl. vii, fig. 12, 1850.

Shell sculptured with low, revolving ridges, which become mere threads on the spire; whorls of the spire nearly flat, with occasional, irregular tubercles; on the back of the shell at the shoulder there are several strong tubercles or knobs, and below these on the body whorl the surface is pinched up into wavy folds; lip very thick, smooth; the subbasal notch wide and shallow; basal notch shallow. Color white, sometimes marbled indistinctly with brown.

Length, 160; diameter, 110 mm.

Culebra Island, one adult; Mayaguez, one young; Aguadilla, Porto Rico (Gundlach); West Indies.

Strombus bituberculatus Lamarck.

Strombus bituberculatus Lamarck, An. sans Vert., vii, p. 202, 1822.
Strombus bituberculatus Reeve, Conch. Icon., vi, pl. xiii, figs. 30 *a*, *b*, 1851.

Aguadilla; Quebradillas; San Juan, Porto Rico (Gundlach).

Strombus gallus Linnæus.

Strombus gallus Linnæus, Syst. Nat., ed., x, p. 748, 1758.
Strombus gallus Reeve, Conch. Icon., vi, pl. ix, fig. 18, 1850.

Aguadilla, Porto Rico (Gundlach).

Family TRIFORIDÆ.

Genus TRIFORIS Deshayes (*em.*), 1824.

Shell small, turriculated, sharp-pointed, many-whorled, generally sinistral; aperture small, terminated by a short canal, and usually with a small canal at or near the posterior angle of the aperture; operculum paucispiral, nucleus subcentral.

Subgenus TRIFORIS s. s.

Triforis turristhomæ Dillwyn.

Turbo turristhomæ Chemn., Conch. Cab., XI, p. 310, pl. CCXIII, figs. 3022 *a–d*, 1795; Dillwyn, Descr. Cat. Rec. Sh., p. 873, 1817.
Cerithium (*Triphora*) *mirabile* C. B. Adams, Contr. to Conch., p. 118, 1850; Tryon, Man., IX, p. 188, pl. XXXIX, fig. 58, 1887.

Shell reversed, with about sixteen whorls which increase slowly; the suture is not impressed and the whorls are sculptured by two revolving rows of strong nodules, the upper row white, the lower chocolate-colored; the two rows of nodules cover the entire surface of the whorls and are separated from each other and at the suture by a groove; last whorl smaller than the penultimate one; aperture suborbicular, very small, with two small canals which are deflected nearly at right angles to the axis of the shell and are open only at the extremity.

Length, 6; diameter, 1.5 mm.

Mayaguez, Porto Rico, one shell with the aperture broken.

Section MASTONIA Hinds.

Triforis melanura C. B. Adams. Plate 58, fig. 7.

Cerithium melanura C. B. Adams, Contr. to Conch., p. 117, 1850.

Shell reversed, slender, conic, the sides regularly sloping to the apex; whorls about fourteen, sculptured by three revolving rows of nodules, which are arranged in slightly oblique rows longitudinally, the sutural furrow the deepest; the middle row of nodules is a little smaller than the others; aperture small, last whorl terminating abruptly; canal short, turning slightly to the right. Color snow white except the apex, which is dark brown.

Length, 5; diameter, 1.25 mm.

Mayaguez, Porto Rico, one young shell.

Triforis intermedia C. B. Adams.

Cerithium (*Triphora*) *intermedium* C. B. Adams, Contr. Conch., p. 119, 1850.
Cerithium turristhomæ d'Orbigny, Moll. Cubana, II, p. 155, pl. XXIII, figs. 10, 12, 1845; not of Dillwyn, 1817.

Shell with about sixteen whorls, the lower part nearly cylindrical, the upper somewhat concavely sloping to the sharp-pointed nucleus, with two revolving rows of nodules; on the lower whorls the space between the rows is widened and has an intermediate revolving thread; suture deep; tube at the base nearly opposite the aperture, pointing obliquely downward. The upper row of nodules is reddish brown, the lower is white.

Length, 6; diameter, 2 mm.

Mayaguez, Porto Rico, one young shell.

Section SYCHAR Hinds.

Triforis samanæ Dall. Plate 54, fig. 18.

Triforis (*Sychar*) *samanæ* Dall, Blake Report, II, p. 248, 1889.

Shell reversed, white, with twelve to fourteen whorls, cylindrical, but with the apex more rapidly tapered; sculpture consisting of three coarse, close-set spiral rows of tubercles, also arranged in longitudinal rows, covering the whole whorl; base having three rows of tubercular cords; canal short; aperture short, squarish.

Length, 10; diameter, 2.8 mm.

Mayaguez, one badly worn shell; Samana Bay, Santo Domingo.

Family CERITHIOPSIDÆ.

Genus SEILA A. Adams, 1861.

Shell small, with elevated, sharp, many-whorled spire, sculptured with strong revolving ridges; columella twisted, with a short, truncated canal below; outer lip not thickened.

Seila terebralis C. B. Adams.

Cerithium terebrale C. B Adams, Bost. Journ. Nat. Hist., III, p. 320, pl. III, fig. 7, 1840.

Shell elongated, sharp-pointed, and regularly increasing, with about fourteen whorls, having four regular revolving ridges on the last whorl and three on the others; ridges even in size, the space between them sculptured with delicate, longitudinal costæ; aperture subquadrate; outer lip showing the ridges and furrows within; columella twisted; canal decidedly truncated; base of shell concave. Color brownish, lighter on the apex.

Length, 8; diameter, 2 mm.

Ensenada Honda, Culebra, two shells.

Genus CERITHIOPSIS Forbes & Hanley, 1849.

Shell imperforate, more or less cylindrical, straight, tuberculous, without varices; whorls numerous; aperture small; canal short, truncated, almost straight; operculum suboval, paucispiral, concave, nucleus sublateral.

Section CERITHIOPSIS s. s.

Cerithiopsis crystallina Dall.

Cerithiopsis ? crystallina Dall, Bull. Mus. Comp. Zool., IX, 1881, p. 89; Blake Report, II, p. 254, pl. XX, fig. 3, 1889.

Shell elongated, with twenty or more whorls, the tip of the nucleus being lost; there are three revolving rows of strong tubercles, that just below the suture being smaller than the other two; the two principal rows somewhat widely separated and having sometimes an intermediate, nodulous thread; columella slightly twisted; canal scarcely truncate below; base with fine, revolving liræ. Color white.

Length, 16; diameter, 2.25 mm.

Aguadilla, Porto Rico, one imperfect shell.

Cerithiopsis pulchella Jeffreys.

Cerithiopsis pulchella Jeffreys, Ann. and Mag. Nat. Hist., II, 1858, p. 129, pl. V, fig. 8 *a–c*.

Shell with the three nuclear whorls smooth and shining; the subsequent whorls have three revolving rows of nodules, of which the central row is most prominent; the last whorl has four rows of nodules, of which the two middle rows are stronger; suture deep; aperture small, subquadrate; canal deeply truncate, short; base below the last row of nodules smooth, concave. Color, pale brownish.

Length, 3; diameter, 0.75 mm.

Mayaguez, Porto Rico, one shell.

Cerithiopsis pupa, n. sp. Plate 53, fig. 16.

Shell minute pupiform, vitreous, white, with a yellow-brown row of large nodules just behind the suture; nepionic whorls missing; subsequent whorls six, with a row of small nodules in front of the suture, in front of which is a row of large ones, both white, then the single brown row forming the periphery; the base has three strong spirals, the posterior one somewhat nodulous; aperture contracted; pillar twisted; canal very short, deep; near the apex there are only two rows of nodules between the sutures, and the brown color of the anterior one is feebler.

Length, 2.5; diameter, 1 mm.

Mayaguez Harbor, at station 6062, Porto Rico, one specimen.

This very pretty little shell has much the same coloration as *Triforis turristhomæ*.

Section EUMETA Mörch.

Cerithiopsis subulata Montagu.

Murex subulatus Montagu, Test. Brit., Suppl., p. 115, pl. XXX, fig. 6, 1808.

Shell with about sixteen whorls, with a well-marked suture, below which is a revolving row of strong tubercles; on the earlier whorls this row of tubercles is connected by low, longitudinal ribs with a larger row of nodules at the base of the whorls; on the lower whorls the longitudinal ribs become faint, and there is a revolving, nodulous thread between the two rows of nodules; the last whorl has four revolving rows of nodules, and its base is concave, with curved radiating growth lines; columella twisted; canal rather long; aperture subquadrate. The upper whorls are purplish; the rest of the shell is brownish horn-colored, the upper row of nodules being darker.

Length, 12; diameter, 3 mm.

One specimen was dredged off Boca Prieta, Porto Rico.

Family CERITHIIDÆ.

Genus CERITHIUM Bruguière, 1789.

Shell imperforate, turriculated, many-whorled, straight; aperture semioval, prolonged into a short, posterior canal above; canal at the base short, oblique, well marked; lip more or less thickened; columella concave; operculum horny, oval, paucispiral, nucleus submarginal.

Cerithium algicola C. B. Adams.

Cerithium algicola C. B. Adams, Proc. Bost. Soc. Nat. Hist., II, p. 5, 1848.
Cerithium algicola Tryon, Man., IX, p. 129, pl. XXII, figs. 81, 82, 1887.

Whorls angular at the middle, sculptured with longitudinal ribs, which are developed into a more or less sharp knob where they cross the angle; surface covered with fine, revolving, raised threads; aperture rounded; columella concave. Color whitish, variegated with fulvous.

Length, 20; diameter, 9 mm.

Puerto Real, Porto Rico, two young shells; St. Thomas, two young specimens.

Cerithium uncinatum Gmelin.

Murex uncinatum Gmelin, Syst. Nat., p. 3542, 1792.
Cerithium uncinatum Tryon, Man., IX, p. 127, pl. XXII, figs. 60, 61, 1887.

Shell with revolving, thread-like sculpture, the middle of the whorls angular, with more or less perfectly developed longitudinal ribs, which generally develop into sharp knobs where they cross the angle of the whorls; the sculpture of the lower whorls sometimes consists of revolving rows of small nodules with intermediate threads; there is a varix on the body whorl opposite to the aperture, and scattered varices on the whorls; upper canal narrow; columella excavated; basal canal short, recurved. Color white, variegated with brown or black, sometimes entirely white.

Length, 22; diameter, 10 mm.

Fajardo; Playa de Ponce; Puerto Real; Guanica; Arroyo; Boqueron Bay; Cabo Rojo light, Porto Rico; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra.

A very abundant and variable species, which sometimes approaches the preceding one, but is generally more finely sculptured.

Cerithium atratum Born.

Cerithium atratum Born, Mus. Cæs. Vind., p. 324, pl. XI, figs. 17, 18, 1780.

Shell with a strong nodulous angle at the middle of the whorls, with a row of smaller nodules just below suture; the two rows of nodules sometimes united, forming short ribs; surface everywhere covered with strong, revolving, thread-like sculpture; upper canal small; basal canal short, reflexed. Color blackish, with broken, revolving white lines; aperture blue, becoming blackish farther in.

Length, 25; diameter, 10 mm.

Puerto Real; Mayaguez; Arroyo; Boqueron Bay; San Juan; Fajardo; Guanica; Ponce, Porto Rico; Ensenada Honda, Culebra.

Cerithium litteratum Born.

Cerithium litteratum Born, Mus. Cæs. Vind., p. 323, pl. XI, figs. 14, 15, 1780.

Shell sculptured with numerous rather fine nodulous revolving ridges; there is a shoulder just below the suture, on which the nodules are often quite strong; there is another nodulous shoulder just above the base of the body whorl; on the body whorl nearly opposite the lip there is a wide, low varix; outer lip thickened, ascending the penultimate whorl; aperture rather large; lower canal short. Color white, finely tessellated with black, the color pattern showing through within the aperture.

Length, 20; diameter, 11 mm.

San Juan; Guanica; Mayaguez; Fajardo, Porto Rico; Vieques; Culebra.

Cerithium litteratum var. **semiferrugineum** Lamarck.

Cerithium semiferrugineum Lamarck, An. sans Vert., VII, p. 74, 1822.
Cerithium semiferrugineum Sowerby, Conch. Icon., XV, pl. VI, fig. 38, 1865.

In this variety the ground is white, sometimes more or less tessellated with brown, and variegated with yellowish brown.

Vieques; Culebra; one shell from each locality.

Cerithium variabile C. B. Adams.

Cerithium variabile C. B. Adams, Proc. Bost. Soc. Nat. Hist., II, p. 5, 1848.
Cerithium variabile Sowerby, Conch. Icon., XV, pl. XIII, fig. 91, 1865.

Shell small, solid, with scarcely rounded whorls, which are sculptured by three revolving rows of tubercles, with about seven or eight rows on the last whorl; opposite the outer lip there is a varix, and there are varices scattered over the whorls; outer lip thick, varicose; aperture small. Color brownish or blackish, often variegated with white.

Length, 12; diameter, 5 mm.

Mayaguez; Boqueron Bay; Puerto Real; San Juan; Ponce; Arroyo, Porto Rico; Ensenada Honda, Culebra; Florida; West Indies.

Cerithium minimum Gmelin.

Murex minimus Gmelin, Syst. Nat., p. 3564, 1792.
Potamides minimus Tryon, Man., IX, p. 167, pl. XXXIV, figs. 9-11, 1887.

Shell only moderately solid, with low, longitudinal ribs and faint revolving ridges, which cut the longitudinal ribs more or less into nodules. In addition to the revolving ridges there are fine revolving threads in their interstices. The aperture is rather large; the basal canal is turned sharply to the left. Color varying from jet black to ashy, variously banded.

Length, 15; diameter, 6 mm.

Puerto Real; Ponce; San Juan; Mayaguez, Porto Rico; Ensenada Honda, Culebra; West Indian region generally; Florida.

This species is quite close in appearance to *C. variabile*. It is generally less solid and more glossy than that species and has more distinct longitudinal ribs. Its aperture is generally larger and the basal canal more distinctly turned to the left. Still, there are specimens that are difficult to name.

Genus PYRAZUS Montfort, 1810.

Shell elongated; whorls angular; aperture subquadrangular, prolonged below; canal almost straight; lip dilated.

Pyrazus degeneratus Dall.

Cerithium (*Pyrazus*) *septemstriatum* var. *degeneratum* Dall, Bull. Mus. Comp. Zool., IX, p. 115, fig. 11, 1894.

Shell thin, brightly colored, finely spirally striate, scarcely sculptured longitudinally, with about six or seven whorls, which are slightly shouldered above; aperture subrhombic; outer lip thin, dilated; canal open.

Length, 12; diameter, 4 mm.

San Juan Harbor, Porto Rico, one shell.

Genus BITTIUM (Leach) Gray, 1847.

Shell small, elongated, with many granulous whorls, which have irregular varices; basal canal short, not curved; outer lip with a varix behind; columella simple; operculum subcircular, paucispiral; nucleus central.

Subgenus DIASTOMA Deshayes.

Bittium varium Pfeiffer.

Cerithium varium Pfeiffer, Arch. für Naturg., 1840, p. 256.
Bittium varium Tryon, Man., IX, p. 152, pl. XXIX, fig. 86, 1887.

Shell with seven or eight more or less rounded whorls, with a distinctly marked suture; sculpture consisting of delicate, longitudinal, slightly curved ribs, which are cut into nodules by revolving grooves; there are about three of these grooves on each whorl; on the body whorl there are additional grooves extending over the base, which is scarcely nodulous; outer lip somewhat patulous; aperture oval; canal not produced, feeble; at some distance back of the lip there is a nearly smooth varix. Color varying from purplish white to purple brown, variously clouded.

Length, 5; diameter, 1.8 mm.

Mayaguez, Porto Rico, one broken shell.

Section ELACHISTA Dall, 1901.

This small group of forms, which seem referable to *Bittium*, was referred by Carpenter to the *Styliferina* of A. Adams, and the senior author of this paper followed this usage in several of his papers without investigation, a course which proves to be incorrect. It seems that each fauna in America, either recent or fossil, Atlantic or Pacific, in the warm-temperate or tropic zone, from the Oligocene to the present day, contains two or more forms of this sort, and the *Bittium elachistum* of the Paris Basin Eocene, described by Cossmann, would appear, from his figures, to belong here. These shells are characterized by their minute pupoid form, the axial sculpture faint and more or less confined to the apical portion, the aperture with hardly a trace of canal or varix. The type may be taken as *B. cerithidioide* Dall (Trans. Wagner Inst., III, p. 276, pl. XVI, fig. 8, 1892). It may be mentioned that this figure is of an immature shell, in which the basal angle is much sharper than in the adult.

Bittium cerithidioide Dall.

? *Alaba cerithidioidea* Dall, Blake Report, II, p. 258, 1889: Trans. Wagner Inst., III, p. 276, pl. XVI, fig. 8, 1892.

Shell with nine or ten whorls, the first three smooth and increasing slightly, the next three carinated below the middle, the lower whorls rounded, those below the fourth generally having delicate, curved, longitudinal ribs; the base is sculptured with faint revolving grooves; aperture somewhat rounded; columella feebly curved and ending in a slight lip below, behind which is a small umbilical chink; outer lip not thickened. Color brownish.

Length, 3.5; diameter, 1.25 mm.

Mayaguez, Porto Rico, six worn and broken shells.

The shells have a strong resemblance to a minute *Cerithidea* before the lip has become thickened and reflexed.

Family MODULIDÆ.

Genus MODULUS Gray, 1840.

Shell perforate, lenticular, turbinate, or trochiform, porcellanous, solid, sculptured; aperture rounded; columella arcuate, ending at its base in a sharp tooth; operculum oval to rounded, multispiral, its nucleus subcentral.

Modulus modulus Linnæus.

Trochus modulus Linnæus, Syst. Nat., ed. X, p. 757, 1758.
Modulus lenticularis Tryon, Man., IX, p. 261, pl. XLVIII, figs. 91, 92, 1887.

Shell solid, lenticular, with a low, rather sharp-pointed spire and a decided peripheral keel, the last whorl decidedly descending at the aperture; upper surface sculptured with low, revolving ridges and a series of rather strong radiating ribs; on the base there are from five to eight strong revolving ridges separated by deep grooves; lips strongly ridged within; basal tooth of the columella horizontally compressed. Color white with small brown spots; on the base the spots occur on the ribs.

Height, 10; diameter, 13 mm.

Boqueron Bay, off Humacao; Fajardo; Guanica; Ponce; Arroyo; Cabo Rojo light; Mayaguez; Puerto Real, Porto Rico; Ensenada Honda, Culebra; Vieques.

In the type the whorls are nearly flat above; in the variety *floridanus* they are somewhat convex and radiately ribbed.

Modulus catenulatus Philippi.

Trochus catenulatus Philippi, Chemnitz Conch. Cab. neue Ausgabe, *Trochus*, p. 110, pl. XVIII, fig. 4, 1851.

Shell trochiform, solid, with a rather high, sharp-pointed spire and flat or slightly concave whorls, the last not descending at the aperture, with a very sharp peripheral keel; base inflated, but somewhat excavated around the small umbilicus, sculptured above and below with rather fine, revolving cords, which are made subnodulous by the crossing of the growth lines; basal tooth sharp, compressed; below it the basal edge of the shell is excavated. Color grayish or brownish, with white dots on the ribs, the base whitish.

Height, 15; diameter, 15 mm.

San Juan, Porto Rico, three worn shells.

The species is abundant on the west coast of tropical America from Panama northward.

Family PLANAXIDÆ.

Genus PLANAXIS Lamarck, 1822.

Shell imperforate, solid, with a thick epidermis, spirally sulcate, conical; spire sharp; aperture oval, notched at the base; lip thick, ridged within; columellar border with a ridge or tubercle above; operculum oval, paucispiral, the nucleus nearly terminal.

Planaxis nucleus Wood.

Buccinum nucleus Wood, Index Test., p. 110, No. 91, pl. XXIII, fig. 91, 1825.
Planaxis nucleus Sowerby, Conch. Icon., XX, pl. I, figs. 7 *a*, *b*.

Shell solid, dark, reddish brown throughout, with six rounded whorls and a sharp spire, sculptured throughout with rather widely spaced grooves, which are well marked below the suture, on the base, and behind the outer lip, but are faint elsewhere; aperture ovate; lip thick, grooved within; basal notch deep and well marked.

Length, 12; diameter, 7 mm.

Ensenada Honda, Culebra; many.

Planaxis lineatus Da Costa.

Buccinum lineatum Da Costa, Brit. Conch., p. 130, 1776.
Planaxis lineatus Sowerby, Conch. Icon., XX, pl. III, fig. 20.

Shell small, solid, acuminate, with slightly convex whorls, the sculpture consisting of rather widely spaced spiral grooves, which are much more distinctly marked on the upper spire and base and which are often wanting elsewhere on the shell. Aperture oval; outer lip very thick, suddenly and briefly deflected above; columella reflexed into a lip below; basal notch round. Color generally whitish or yellowish, with close, revolving brown bands, sometimes uniform yellowish.

Length, 7; diameter, 3.5 mm.

San Juan; Puerto Real; Mayaguez; Hucares; Ponce, Porto Rico; Ensenada Honda, Culebra.

A uniformly yellow specimen was obtained at Hucares, Porto Rico.

Family VERMETIDÆ.

Genus VERMICULARIA Lamarck, 1799.

Shell free, regularly coiled in its earlier stages, like a *Turritella;* subsequently uncoiled and irregular, operculum filling the aperture, horny, circular, concave.

Vermicularia spirata Philippi.

Vermiculus spiratus Philippi, Arch. für Naturg., 1836, p. 244.
Vermetus spiratus Tryon, Man., VIII, p. 187, pl. LV, figs. 99, 100, 1886.

Shell when young closely coiled for the first six or eight whorls; these whorls are smooth and have a sharp, pinched-up carina below the center; the later whorls become uncoiled and irregular, the sculpture consisting of threads and ridges which are nearly parallel with the direction of the shell. Color brownish or purplish brown.

The species sometimes attains a length of 15 cm. and a diameter at the aperture of 12 or 14 mm.

Mayaguez, several young specimens.

Genus PETALOCONCHUS Lea, 1843.

Shell solitary or a few clustered together, spirally and irregularly twisted, affixed, and usually decussated, with two internal ridges running spirally along the columella, which become obsolete near the aperture, operculum spiral.

Petaloconchus erectus Dall.

Vermetus (*Petaloconchus*) *erectus* Dall, Blake Report, II, p. 262, pl. XXXVIII, fig. 4, 1889.

Nucleus small, polished; early part of shell prone, irregularly contorted; longitudinally ridged and in fine specimens decussated; latter part of the tube rises vertically or nearly so, is smaller and nearly smooth. Color yellowish or grayish white. There are two internal laminæ near the apex.

Height of erect part, about 25; diameter of aperture, 2 mm.

Mayaguez Harbor, Porto Rico, several specimens.

Genus BIVONIA Gray, 1842.

Bivonia decussata Lamarck.

Serpula decussata Lamarck, An. sans Vert., v, p. 363, 1818.
Vermetus conicus var. *decussatus* Tryon, Man., VIII, p. 170, pl. XLIX, fig. 24, 1886.

Quebradillas (Gundlach).

Family TURRITELLIDÆ.

Genus TURRITELLA Lamarck, 1799.

Shell greatly elongated, many-whorled and evenly tapering, sculptured with spiral striæ or ridges; aperture rounded or subquadrate, entire, lip thin, externally flexuous; operculum horny, multispiral; nucleus central.

Section HAUSTATOR Montfort.

Turritella variegata Linnæus.

Turbo variegatus Linnæus, Syst. Nat., ed. X, p. 767, 1758.
Turritella variegata Reeve, Conch. Icon., v, pl. v, fig. 19, 1849.

Shell with nearly flat whorls, but having the suture well marked by a slight shoulder above and below it; the sculpture consisting of fine, revolving threads and some seven or eight low but rather sharp ridges; aperture varying from rounded to subquadrate. Color pale brownish, variegated with indistinct longitudinal strigations of chocolate or purplish brown.

Length, 70; diameter, 18 mm.

Catona; Fajardo; Cabo Rojo light, Porto Rico; worn shells.

Section TORCULA Gray.

Turritella exoleta Linnæus.

Turbo exoletus Linnæus, Syst. Nat., ed. X, p. 766, 1758.
Turritella exoleta Reeve, Conch. Icon., v, pl. VI, fig. 22, 1849.

Shell with sixteen or seventeen whorls, which are rudely ridged above and below and concave in the middle; this concave space is sometimes crossed by thin lamellæ; lower rib of the body whorl double; aperture sinuate in the middle of the outer lip, subquadrate. Color yellowish white, obscurely flamed with orange brown.

Length, 60; diameter, 15 mm.

Mayaguez, Porto Rico, two young, worn specimens.

Family LITORINIDÆ.

Genus LITORINA Férussac, 1821.

Shell imperforate, turbinate, colored; aperture rounded, not notched below, the outer lip not thickened; columella flattened or excavated; operculum horny, paucispiral; nucleus more or less excentric.

Section MELARAPHE Muhlfeld, 1828.

Shell rather thin, conical, with pointed spire; surface with revolving sculpture, usually variegated.

Litorina ziczac Gmelin.

Trochus ziczac Gmelin, Syst. Nat., p. 3587, 1792.
Littorina ziczac Reeve, Conch. Icon., x, pl. XI, fig. 57, 1857.

Shell with scarcely rounded whorls and a well-defined peripheral keel near the base of the last whorl; the whole surface is covered with delicate, rather widely spaced grooves; aperture small, irregularly oval; the thin lip extends upward above the keel on the body whorl, forming a canal; base a little produced. Color whitish, with close, sharply defined, longitudinal, wavy or zigzag stripes of brownish; sometimes the shell is faintly banded; aperture dark, with a light band.

Length, 15; diameter, 9 mm.

Aguadilla; San Geronimo; San Juan, Porto Rico; Ensenada Honda, Culebra,

Litorina ziczac var. lineata Lamarck.

Phasianella lineata Lamarck, An. sans Vert., VII, p. 54, 1822.
Littorina ziczac var. *lineata* Tryon Man., IX, p. 251, pl. XLV, fig. 7.

Shell smoother than the type, the whorls more convex and less sharply angulate at the base. The color pattern is generally less distinct than in the *ziczac*.

Aguadilla; San Juan; Hucares; Puerto Real, Porto Rico.

Litorina tessellata Philippi.

Littorina tessellata Philippi, Abbild. und Beschr., Heft VIII, p. 226, pl. V, fig. 26, 1847.

Shell with convex whorls, which are sometimes slightly shouldered above, and a sharp apex, the suture plainly marked; last whorl bluntly angulated at base, sculptured throughout with delicate, evenly spaced grooves; aperture irregularly oval, the lip extending above angle of penultimate whorl; columella flattened, ending in a ridge below, behind which the parietal wall is excavated. Color bluish or greenish white, alternating with square, brown tessellations, the tessellations in oblique or zigzag rows; aperture brownish purple, the inside of outer lip showing the outside color pattern.

Length, 15; diameter, 10 mm.

Ensenada Honda, Culebra, two specimens.

This species resembles *L. ziczac* in many respects, but is rather shorter in proportion, has more rounded whorls, which are often slightly shouldered above; the aperture is more purplish and has no white band within.

Litorina angulifera Lamarck.

Phasianella angulifera Lamarck, An. sans Vert., VII, p. 54, 1822.
Littorina scabra var. *lineata* Tryon, Man., IX, p. 243, pl. XLII, figs. 11-13, 15-17, 1887.

Shell thin, with rounded whorls and a sharp-pointed spire; the surface everywhere covered with fine, revolving, engraved lines, which are sometimes so near together that the ridges between them appear as close revolving threads; surface generally slightly decussated by the growth lines; aperture nearly evenly oval; outer lip thin; columella often a little excavated below. The color pattern varies greatly; the ground may be gray, yellowish, reddish, or purplish, and is generally marked with darker, oblique strigations, which are often only faintly defined; columella usually tinted with violet.

Length, 30; diameter, 17 mm.

Ponce, Porto Rico; Ensenada Honda, Culebra; a small, slender, light-colored variety was obtained at San Juan, Porto Rico; West Indies; Florida.

Litorina columellaris d'Orbigny.

Littorina columellaris d'Orbigny, Voy. Amér. Mér., p. 392, 1840; Moll. Cubana, I, p. 213, pl. XIII, figs. 18-20, 1841.

Shell rather solid, sharp-pointed, with rounded whorls, the last generally compressed or a little concave just below the suture, covered everywhere with fine, revolving threads, and slightly decussated by growth lines; aperture suboval; outer lip not greatly thickened; columella wide, nearly straight, excavated below. Color yellowish to ashy, the upper whorls marked with darker color, in tessellations, lines, or clouds; columella purple.

Length, 25; diameter, 16 mm.

San Juan, Porto Rico; many young shells; West Indies; mainland of northern South America to Mexico.

Often close to *L. angulifera*, but a solider shell, with a wider, straighter columella.

Section LITORINA s. s.

Litorina guttata Philippi.

Littorina guttata Philippi, Abbild. und Beschr., II, p. 197, pl. IV, fig. 7, 1847.

Quebradillas, Porto Rico (Gundlach).

Litorina mespilum Muhlfeld.

Helix mespilum Muhlfeld, Verh. Berl. Ges. Nat., I, 1824, p. 219, pl. VIII, fig. 8.

San Juan, Porto Rico (Gundlach).

Genus TECTARIUS Valenciennes, 1833.

Shell perforate or imperforate, turbinate, solid, subconic, tuberculous or spinose; spire pointed; aperture oval, entire; operculum paucispiral.

Tectarius muricatus Linnæus.

Turbo muricatus Linnæus, Syst. Nat., ed. x, p. 761, 1758.
Littorina muricata Reeve, Conch. Icon., x, pl. ii, fig. 11, 1857.

Shell perforate, with about eight somewhat rounded whorls, which are slightly shouldered above, the sculpture consisting of about four revolving rows of somewhat sharp nodules, with from five to eight rows of flatter nodules on the base, which fade out into mere ribs at the umbilicus; aperture ovate; outer lip thickened, scarcely produced at the base; the umbilicus continuing down the columella as a groove. Color ashy, the interior of the aperture brown.

Length, 20; diameter, 15 mm.

Cabo Rojo light; San Geronimo; San Juan; Arroyo; Puerto Real; Aguadilla, Porto Rico; Caballo Blanco, Vieques; Ensenada Honda, Culebra; West Indian region; Florida Keys.

Tectarius trochiformis Dillwyn.

Turbo trochiformis Dillwyn, Cat. Rec. Sh., ii, p. 826, 1817.
Tectarius nodulosus Tryon (part), Man., ix, p. 258, pl. xlviii, fig. 72, 1887.

Shell imperforate solid, with about eight whorls, which are sculptured with revolving rows of strong, sharp nodules. There are two rather pronounced rows of nodules on the upper whorls, one just below the suture, another lower down forming a shoulder. On the last whorl there are three of these more conspicuous rows, the two lower ones forming a biangulation on the periphery. Besides these there are revolving threads and rows of small nodules covering the entire shell; aperture suboval, outer lip rather thin; columella wide, excavated, base produced; operculum paucispiral. The shell is generally dark lead-color, the nodules lighter; aperture dark brown with a white stripe below.

Length 18; diameter, 13 mm.

San Geronimo; Aguadilla; Puerto Real, Porto Rico.

This mollusk is quite common on the lower Keys of Florida, and is often confounded with *Echinella nodulosa* Pfeiffer, which it somewhat resembles. The former has a paucispiral operculum, while that of the latter is multispiral.

Family LITIOPIDÆ.

Genus ALABA A. Adams, 1862.

Shell elongated, pointed, with numerous rounded whorls which may be smooth or spirally lineate, with irregularly distributed varices; aperture oval; lip scarcely thickened, smooth within; columella subtruncate at the base.

Alaba tervaricosa C. B. Adams. Plate 58, fig. 8.

Alaba tervaricosa Mörch, Malak. Blatt. xxiii, p. 57, 1876.
Rissoa tervaricosa C. B. Adams, Proc. Bost. Soc. Nat. Hist., ii, p. 6, 1845.

Shell with about thirteen rounded whorls which gradually increase, the first five or six dark colored and smooth, the remainder whitish or ashy, often marked with brownish, and sculptured with very delicate revolving threads, which are reticulated by the growth lines; there are a number of rounded varices on the whorls; aperture oval; columella slightly truncate below.

Length, 6; diameter, 2.5 mm.

San Juan Harbor, Porto Rico; one shell; widely distributed.

A. melanura Adams appears to be only a more slender variety of the same species.

Family SOLARIIDÆ.

Genus SOLARIUM Lamarck, 1799.

Shell widely umbilicated, conic, depressed, angular at the periphery, solid; nucleus sinistral, oblique, whorls sculptured; aperture subquadrangular; umbilicus funicular bordered by a crenulated carina; columella vertical; operculum horny, spiral, concave, or flat externally, with a tubercle on its internal face.

Solarium nobile Hanley.

Solarium nobile Hanley, Thes. Conch., iii, p. 230, fig. 35, 1866.

Umbilicus rather narrow, deep, the crenulations surrounding it very strong; the suture well marked; there are four strong rows of elongated tubercles on the whorls, and on the upper whorls here are two fainter rows in the sutures; periphery narrow, rounded; base with five or six revolving rows of tubercles. Purplish flesh color, with scattered brown markings on the rows of nodules; periphery whitish, occasionally spotted above.

Diameter, 40; height, 20 mm.

San Juan Harbor; Mayaguez, Porto Rico; Texas.

Solarium bisulcatum d'Orbigny.

Solarium bisulcatum d'Orbigny, Moll. Cubana, II, p. 66, pl. XIX, figs. 17-20, 1845.

Shell small, depressed, with a wide umbilicus; spire scarcely elevated, with flat whorls; these are sculptured with revolving grooves which are cut by radiating furrows into granules, the rows just above and below the suture being strongest; on the periphery there are two nearly equal rows of nodules; the sculpture of the base is much like that above; crenations around the umbilicus moderate; aperture nearly round. Color dirty white.

Diameter, 10; height, 2 mm.

Mayaguez, Porto Rico; several worn shells.

Section PHILIPPIA Mörch.

Solarium krebsii Mörch.

Solarium Krebsii Mörch, Malak. Blatt., 1875, p. 155.

Quebradillas, Porto Rico (Gundlach).

Genus TORINIA Gray, 1840.

Shell varying from planorbiform to turbinately elevated, umbilicus perspective; its margins slightly crenate; operculum corneous, generally conically elevated, externally spiral, with projecting edges; internal face smooth, with a spirally twisted elevation.

Torinia cylindrica Gmelin.

Trochus cylindricus Gmelin, Syst. Nat., p. 3572, 1792.
Torinia cylindrica Marshall, Tryon's Man., IX, p. 17, pl. V, fig. 82, 1887.

Shell conic, elevated; whorls somewhat rounded, with spiral sulcations, ten-ribbed, the three peripheral ribs the strongest; umbilicus deep, scarcely diminishing, its border feebly crenate. Color chestnut brown, sparingly mottled with white at the periphery and above the suture.

Height, 13; diameter, 13 mm.

Puerto Real; Cabo Rojo light; Guanica, Porto Rico; one specimen in bad condition from each locality.

Torinia æthiops Menke.

Solarium æthiops Menke, Syn. Moll., ed. II, p. 147, 1830.
Torinia æthiops Marshall, Tryon's Man., IX, p. 18, pl. V, figs. 85, 86, 1887.

Porto Rico (Gundlach, Menke).

Genus OMALAXIS Deshayes, 1830.

Shell discoidal, more or less uncoiled, flat or concave above, the last whorl bicarinated or quadrate in section; nucleus sinistral, papillose, depressed; aperture subquadrate, lip sharp.

Omalaxis exquisita, n. sp. Plate 54, fig. 12.

Shell minute, with discontinuous whorls in one plane, subquadrate in section, with a minutely serrate keel at each angle; whorls three, the nepionic one sinistral and depressed, the others free; pellucid whitish, with indications of brown flammulæ; whorl four-keeled, the inner keels nearer each other than the peripheral pair; shell between the keels polished, smooth; above and below slightly convex, but between the peripheral keels somewhat concave.

Maximum diameter of shell, 3; minimum diameter, 2; height, 1 mm.

Mayaguez Harbor, Porto Rico, at station 6062, in 25 fathoms, four specimens.

This is one of the most exquisite little gems of the sea that can be imagined.

Family RISSOIDÆ.

Genus RISSOA Frèminville, 1813.

Section ALVANIA Leach, 1896.

Surface reticulate.

Rissoa epima, n. sp.

Shell small, subtranslucent, pinkish white, with a touch of purple brown on the pillar lip, reticulated, five-whorled; two nepionic whorls whitish, smooth, not polished; subsequent whorls with narrow, hardly flexuous, rounded axial ribs, with slightly wider interspaces extending from suture to suture but not over the base, and crossed above the suture by three subequal, nearly equally spaced, spiral threads, slightly tumid at the intersections; the posterior one nodulous at the intersections; on the base five simple threads, the posterior one of which marks the line of the suture and the anterior ending of the axial ribs; aperture rounded ovate, the lip continuous, simple, moderately thickened; throat not lirate; suture deep.

Length of shell, 2; of last whorl, 1.25; maximum diameter, 1.12 mm.

Mayaguez Harbor, Porto Rico, at station 6062, in about 25 fathoms, sand, one specimen.

Although this species has no very strong characteristics, it does not seem practicable to unite it with any of the species of *Alvania* known from the West Indies. It is more slender than any of the others, proportionally, and has a different number of spirals from any mentioned by Mörch.

Section THAPSIA Monterosato, 1884.

Rissoa portoricana, n. sp. Plate 53, fig. 20.

Shell small, thin, rather slender, bluish white, with five sculptured whorls; sutures rather deep, whorls convex, the nepionic smooth and inflated, the subsequent minutely spirally threaded with rather distant threads crossing feeble and rather irregular axial ridges, which become obsolete near the periphery; aperture with the margin slightly thickened; a minute chink behind the callus at the pillar.

Length, 3; maximum diameter, 1 mm.

Mayaguez Harbor, Porto Rico, at station 6062, in 25 fathoms, one specimen.

A small and inconspicuous species, but unlike any other yet known from the region.

Genus RISSOINA d'Orbigny, 1840.

Shell rissoiform, turriculated, with numerous whorls which are somewhat convex; apex mammillar; aperture oval, semilunar; lip thickened within and without, canaliculate or subcanaliculate at the base; operculum oval, elongate, horny, paucispiral, with an excentric nucleus; its internal face bearing a club-shaped appendage.

Rissoina decussata Montagu.

Turbo decussatus Montagu, Test. Brit., p. 399, 1803.
Rissoina decussata Tryon, Man., IX, p. 385, pl. LVIII, figs. 15–17, 1887.

Shell with about twelve nearly flat whorls, with an elevated, sharp spire, sculptured with from twenty-five to twenty-eight delicate, longitudinal riblets, which are crossed by very fine revolving striæ; outer lip very heavy; aperture almost semilunar; columella nearly straight, somewhat excavated in the middle; basal canal feeble. Color white.

Length, 6; diameter, 2.5 mm.

San Juan Harbor, Porto Rico; several broken specimens.

Tryon's figures do not accurately represent the aperture of this species. It was erroneously described as a British species by Montagu.

Rissoina browniana d'Orbigny.

Rissoina browniana d'Orbigny Moll. Cubana, p. 28, pl. XII, figs. 33, 35, 1842.
Rissoa lævissima C. B. Adams, Contr. to Conch., 1850, p. 115.

Shell smooth, with eight nearly flat whorls, highly polished, slightly curved; apex acute; aperture rather small; outer lip much thickened. Color white, sometimes with two or three pale bands, which are, however, quite evanescent.

Length, 4; diameter, 1.5 mm.

Mayaguez, Porto Rico; two shells.

Rissoina chesnelii Michaud.

Rissoa chesnelii Michaud, Desc. des Coq. Nouv., p. 17, 1832.
Rissoina chesneli Schwartz v. Mohr., Mon. Rissoina, p. 73, pl. v, figs. 38, 39, 1860.

Shell white, with eight somewhat rounded whorls, having about fourteen strong, longitudinal costæ with about equal interspaces which are scarcely spirally striate; columellar callus solid, elevated. There is a revolving oblique ridge at the base of the shell. Length, 4; diameter, 1.5 mm.

Mayaguez, Porto Rico; a fragment.

Rissoina cancellata Philippi.

Rissoina cancellata Philippi, Zeits. für Mal., 1847, p. 127; Schwartz v. Mohr., Mon. Rissoina, p. 89, pl. VII, fig. 52, 1860.

Shell white, with ten convex whorls which are cancellated with sixteen to eighteen longitudinal ribs and four or five revolving ridges; revolving ridges on the base numerous; outer lip strong; basal notch well developed. There is a faint revolving rib at the base of the shell. Length, 8; diameter, 3 mm.

Mayaguez, Porto Rico; Vieques.

Subfamily HYDROBIINÆ.

Genus POTAMOPYRGUS Stimpson, 1865.

Potamopyrgus coronatus Pfeiffer.

Paludina coronata Pfeiffer, Arch. für Naturg., I, 1840, p. 253.
Amnicola coronata Fischer & Crosse, Mission Sci. Mexique, pt. VII, vol. II, p. 266, pl. L, figs. 6 *a–e*, 1891.

Several localities in Porto Rico; Vieques; Cuba, and other localities in the West Indies (Fischer & Crosse); Texas; Mexico; Central America; Colombia; Venezuela, etc.

The variety *crystallinus* Shuttleworth is also reported from Porto Rico.

Family CYCLOPHORIDÆ.

Shell variable in form, turbinate, turriculated, or subdiscoidal; aperture rounded; peristome simple or reflexed; operculum circular; jaw formed of two triangular pieces.

Genus MEGALOMASTOMA Guilding, 1840.

Shell perforate, elongate, turriculate, or pupiform; apex generally decollated; aperture subcircular; peristome continuous; operculum horny, circular, flat, arctispiral, with a central nucleus.

Type, *Megalomastoma antillarum* Sowerby.

Megalomastoma croceum Gmelin. Plate 53, fig. 1.

Helix crocea Gmelin, Syst. Nat., p. 3655, 1792; Chemnitz, Conch. Cab., IX, pl. 135, fig. 1233.
Megalomastoma cylindraceum Sowerby, Conch. Icon., XX, pl. X, fig. 91, 1878.

Shell elongated, subcylindrical, with fine, oblique, flexuous striæ, which, with the epidermis, are usually eroded away; whorls remaining from six to eight, scarcely convex, the first one to one and a half decollated; aperture nearly circular; peristome continuous, appressed to the last whorl, but little thickened, slightly reflexed; umbilicus a mere chink. The surface, where not eroded, is generally horn colored, but ordinarily it is a dirty white or reddish ash. Sometimes the last whorl or two are flushed with reddish brown or violet.

Length, 30; diameter, 12; length of aperture, 7 mm.

El Yunque, Porto Rico; several dead specimens.

Megalomastoma croceum var. curtum Dall & Simpson. Plate 53, fig. 2.

A small variety, having only six remaining whorls, was found at Hucares, Porto Rico.

Length, 21; diameter, 10 mm.

Megalomastoma hjalmarsoni Pfeiffer.

Megalomastoma hjalmarsoni Pfeiffer, Mal. Blätt., XXII, p. 119, 1875.

Lares; Mayaguez, western Porto Rico (Crosse).

Megalomastoma verruculosum Shuttleworth.

Cyclostoma (*Megalomastoma*) *verruculosum* Shuttleworth, Diagn. neue Moll., Berner Mitth., 1854, p. 90.

Eastern Porto Rico (Crosse).

Family CYCLOSTOMATIDÆ.

Genus CHOANOPOMA Pfeiffer.

Choanopoma decussatum Lamarck.

Cyclostoma decussata Lamarck, An. sans Vert., vi, p. 147, 1822.

Porto Rico, many localities (Crosse).

Choanopoma senticosum Shuttleworth.

Cyclostoma (*Choanopoma*) *senticosum* Shuttleworth, Diagn. neue Moll., Berner Mitth., 1854, p. 90.

Porto Rico; Isle of Vieques (Crosse).

Choanopoma sulculosum Pfeiffer.

Cyclostoma sulculosum (Férussac MS.) Pfeiffer, in Conch. Cab., *Cyclostoma*, p. 313, pl. XLI, figs. 15–17, 1858.

Isle of Vieques; St. Bartholomew (Crosse).

Genus CISTULA Gray, 1850.

Cistula riisei Pfeiffer.

Cistula riisei Pfeiffer, Mon. Pneum. Viv., p. 417, 1852.

Porto Rico, several localities (Crosse).

Cistula aguadillensis Pfeiffer.

Cistula aguadillensis Pfeiffer, Mal. Blätt., XXII, p. 207, 1875.

Aguadilla; Penuelas, Porto Rico (Crosse).

Cistula lineolata Lamarck.

Cyclostoma lineolata Lamarck, An. sans Vert., IV, p. 147, 1822.

Puerto Rico (Crosse).

Genus CHONDROPOMA Pfeiffer, 1847.

Chondropoma terebra Pfeiffer.

Chondropoma terebra Pfeiffer, Mal. Blätt., VIII, p. 74, pl. II, figs. 4–6, 1861.

Sierra Morales, Porto Rico (Crosse).

Chondropoma blauneri Shuttleworth.

Cyclostoma (*Chondropoma*) *blauneri* Shuttleworth, Diagn. neue Moll., Berner Mitth., 1854, p. 91.

Humacao, Porto Rico (Crosse).

Chondropoma swifti Shuttleworth.

Cyclostoma (*Chondropoma*) *swifti* Shuttleworth, Diagn. neue Moll., Berner Mitth., 1854, p. 91.

Near Ponce, Porto Rico (Crosse).

Chondropoma newtoni Shuttleworth.

Cyclostoma (*Chondropoma?*) *newtoni* Shuttleworth, Diagn. neue Moll., Berner Mitth., 1854, p. 92.

Near Arecibo, Porto Rico (Crosse).

Family TRUNCATELLIDÆ.

Shell cylindrical, truncated in an adult state; aperture entire, oval; peristome continuous, thickened; operculum oval, paucispiral, its nucleus excentric.

Genus TRUNCATELLA Risso, 1826.

Shell with longitudinal ribs, shining; operculum horny.

Type, *T. truncatula* Draparnaud.

Truncatella caribæensis Sowerby. Plate 53, fig. 7.

Truncatella caribæensis (Sowerby MSS.) Reeve, Conch. Syst., II, pl. CLXXXII, fig. 7, 1842.

Shell subrimate, subcylindrical, in the adult state, but slightly decreasing in size toward the apex; amber colored, with delicate, scarcely curved ribs, which are often faint on the middle of the whorls; whorls three and one-half to four, but little rounded, the last with a feeble basal carination; aperture subvertical, oval; peristome thickened on its inner lip and pressed in to the last whorl; outer lip reflexed.

Length, 7; diameter, 2.5 to 3 mm.

Ensenada Honda, Culebra, one specimen; also various West Indian localities; Florida, etc.

Truncatella subcylindrica Linnæus.

Helix subcylindrica Linnæus, Syst. Nat., ed. XII, p. 1248, 1767; Pulteney, Cat. Dorset, p. 19, 1799; Montagu, Test. Brit., II, p. 393, 1803 (Ed. Chenu, p. 173); Hanley, Ips. Lin. Conch., p. 379, 1855.
Truncatella subcylindrica Gray, in Turton, Man., p. 295, fig. 72, 1857.
Truncatella montagui Lowe, Zool. Journ., V, p. 303, 1831; Thorpe, Brit. Marine Conch., p. 146, fig. 75, 1844.
Turbo truncatus Montagu, II, p. 300, pl. X, fig. 7, 1803; Turton, Conch. Dict., p. 218, 1819.
Turritella truncata Fleming, Brit. An., p. 303, 1828.
Turbo subtruncatus Montagu, p. 300, pl. X, fig. 1 (young), 1803: Turton, Conch. Dict., p. 219, 1819.
? *Truncatella subcylindrica* Pfeiffer, Mon. Auric., p. 186, 1833; Binney, Bost. Journ. Nat. Hist., VII, p. 186 (ex parte), pl. LXXV, fig. 6 (only), 1859.

Porto Rico; adventitious in England; common in Florida and many localities in the West Indies.[1]

Truncatella pulchella Pfeiffer.

Truncatella pulchella Pfeiffer, Archiv. für Naturg., I, 1839, p. 356; Binney, Bost. Journ. Nat. Hist., VII, p. 189, pl. LXXV, figs. 1, 9, 10, 1859.

Fajardo, Porto Rico (Crosse); other localities in the West Indies; also Florida.

Truncatella clathrus Lowe.

Truncatella clathrus Lowe, Zool. Journ., V, p. 303, 1831; Reeve, Conch. Syst., II, pl. 182, fig. 3, 1842; Küster, Conch. Cab., p. 15, 1856.

Rare in Porto Rico (Crosse); St. Thomas; Bermuda (Verrill).

Family CALYPTRÆIDÆ.

Genus CHEILEA Modeer, 1793.

Shell conical, irregular, lamellated or rayed; the summit subcentral; nucleus subspiral, dextral, slightly posterior, within bearing a halt cup-shaped appendage, attached behind the summit and open in front; edge of the shell irregular; opercular plate basal, calcareous.

This is better known by the name of *Mitrularia* Schumacher.

Cheilea equestris Linnæus.

Patella equestris Linnæus, Syst. Nat., ed. X, p. 780, 1758.
Mitrularia equestris Tryon, Man., VIII, p. 137, pl. XLI, figs. 25–32, 1886.

Shell irregularly conical, thin or subsolid, pure dead white without and shining white within, sculptured with fine radiating threads and strong, very irregular, oblique corrugations or wrinkles, which sometimes break up into frills near the base; apex spiral, with one to one and a half whorls, posterior; interior process attached along the posterior part of the shell, elongated, so that the points may reach below the base of the shell, obliquely truncated.

Diameter, 40; height, 23 mm.

Aguadilla; San Juan, Porto Rico; St. Thomas.

Genus CALYPTRÆA Lamarck, 1799.

Shell low conical, with central spiral apex; aperture basal, circular, entire; interior having a spiral diaphragm, the columellar margin of which is twisted, forming a false umbilicus.

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[1] The synonymy found in Pfeiffer, Binney, and the usual works of reference contains so many errors that it was thought best to expand it more than we have usually attempted in this report.

Calyptræa candeana d'Orbigny.

Infundibulum candeanum d'Orbigny, Moll. Cubana, II, p. 190, pl. XXV, figs. 28-29, 1845.

Shell small, rounded, thin; spire elevated; growth lines rugose; sometimes obsoletely, finely, radiately striate; white within and without.

Diameter, 5; height, 2 mm.

Mayaguez, Porto Rico, a great number of dead shells.

Genus CREPIDULA Lamarck, 1799.

Shell oval to oblong; apex posterior, oblique; interior porcellanous, shining; a thin, horizontal septum or shelf occupies nearly the posterior half of the shell within; free border of shelf straight or arcuate.

Crepidula aculeata Gmelin.

Patella aculeata Gmelin, Syst. Nat., p. 3693, 1792.
Crepidula aculeata Tryon, Man., VIII, p. 129, pl. XXXIX, figs. 61-65, 1886.

Shell irregularly oval, with one and a half to two whorls, the nuclear whorl smooth and very distinct from the rest of the shell; growth lines rough, sometimes a little imbricated; the surface is generally covered with subspiral lines of erect, prickly, often tubular scales; growth lines of the shelf finely marked, and with the edge of the shelf shaped something like a brace (⏞). Color whitish, variegated with brown; the shelf white, with translucent lines.

Length, 28; breadth, 21; height, 10 mm.

Arroyo and off Point Melones, Porto Rico. Distributed almost universally throughout the warm seas of the globe. Young specimens of one or two other species were obtained by the *Fish Hawk* expedition, but not in condition to be satisfactorily named.

Crepidula riisei Dunker.

Crepidula riisei Dunker, Zeitschr. Mal., p. 59, 1852; Mörch, Mal. Blätt., XXIV, p. 105, 1877.
Crepidula protea d'Orbigny (ex parte), Moll. Cubana, II, p. 192, pl. XXIV, figs. 32, 33, 1845.

San Juan, Porto Rico, Riise; Mayaguez Harbor, U. S. Fish Commission.

This form much resembles the *Crepidula plana* Say, being a resident of the inside of dead shells, but may be distinguished by its traces of longitudinal brown lines near the apex and its fringed and conspicuous periostracum.

Crepidula protea d'Orbigny.

Crepidula protea d'Orbigny, Moll. Cubana, II, p. 192 (ex parte), pl. XXIV, figs. 30, 31, 1845.

A single specimen of this species was obtained at Mayaguez, Porto Rico.

Family AMALTHEIDÆ.

Genus AMALTHEA Schumacher, 1817.

Shell irregular, conic, with the apex curved and directed to the rear, sometimes coiled; surface irregular; muscular impression horseshoe-shaped; base thick or excavated.

Amalthea antiquata Linnæus.

Patella antiquata Linnæus, Syst. Nat., ed. XII, p. 1259, 1767.
Hipponyx antiquatus Tryon, Man., VIII, p. 134, pl. XL, figs. 93-99, 1886.

Shell white, the apex posterior; concentrically rudely and closely lamellated, more or less radiately striate: epidermis pilose.

Length, 18, height, 7 mm.

Puerto Real; Arroyo; Aguadilla, Porto Rico; Ensenada Honda, Culebra.

Amalthea subrufa Lamarck.

Pileopsis subrufa Lamarck, An sans Vert., VI, part II, p. 18, 1822.
Hipponyx subrufus Tryon, Man., VIII, p. 134, pl. XL, fig. 1, 1886.

Quebradillas, Porto Rico (Gundlach).

A young specimen of what is probably this species was obtained by the *Fish Hawk* expedition at Mayaguez, Porto Rico.

Family XENOPHORIDÆ.

Genus XENOPHORA Fischer de Waldheim, 1807.

Shell trochiform, concave or flat below; whorls flat, bearing a row of extraneous objects, which are attached near the suture; sometimes these are placed all over the upper part of the shell; last whorl compressed and carinated at the periphery; aperture large, oblique; operculum suboval or trapezoidal.

Xenophora caribæa Petit.

Xenophora caribæa Petit, Journ. de Conchyl., 1856, p. 248, pl. x, figs. 1, 2.

Thin, pale yellowish brown or whitish, white beneath; the carina of the last whorl extended much beyond the base; the surface sculptured with fine, oblique, corrugated wrinkles, and having an interrupted row of fragments agglutinated along the suture; base with faint, revolving lines, crossed by very fine growth lines; umbilicus moderate.

Diameter, 60; height, 30 mm.

One young specimen was obtained at Aguadilla, Porto Rico.

Family NATICIDÆ.

Genus NATICA Scopoli, 1777.

Shell oval or globular, porcellanous, shining, solid, generally smooth, umbilicated, the umbilicus spirally ribbed; aperture semilunar or oval, entire; columellar edge subvertical; operculum semilunar, calcareous, paucispiral, its nucleus excentric, the outer surface often spirally ribbed.

Natica canrena (Linnæus) Auctorum.

Nerita canrena Linnæus, Syst. Nat., ed. x, p. 776, 1758 (ex parte).
Natica canrena Reeve, Conch. Icon., ix, pl. iv, fig. 14, 1855.

Shell with five and a half rounded whorls, the suture well impressed, the surface below it slightly flattened and wrinkled, last whorl descending; aperture large, semioval; umbilicus narrow, spirally entering; upper callus of the columella short, separated from the lower callus by a square notch. The ground color varies from whitish to tawny; the last whorl has three rather broad, darker bands about its middle, and over entire shell, except the base, there are wavy or zigzag, longitudinal strigations, which show through the dark bands to some extent; base white. Sometimes it has very faint revolving sculpture.

Height, 45; diameter, 40 mm.

Mayaguez, Porto Rico; one large, broken shell and two young ones.

The original *N. canrena* of Linnæus comprised several species.

Natica sagraiana d'Orbigny.

Natica sagraiana d'Orbigny, Moll. Cubana, ii, p. 34, pl. xviii, figs. 20, 22, 1842.

San Juan; Quebradillas, Porto Rico (Gundlach).

Section STIGMAULAX Mörch, 1852.

Natica sulcata Born.

Nerita sulcata Born, Mus. Cæs. Vind., p. 400, pl. xvii, figs. 5, 6, 1780.

Shell with six rounded whorls which are not flattened on the shoulder, shining, sculptured throughout with strong, longitudinal ribs; these are crossed by rather fine, impressed striæ, which give the surface a somewhat cancellated appearance; umbilicus rather strong and opening near the upper end of the columella, the revolving ridge within it wide and rounded. Color pale fulvous, irregularly banded with darker color, often marked with wavy, longitudinal markings; sometimes the shell is nearly a uniform livid brown; base white.

Height, 20; diameter, 18 mm.

Porto Rico, no special locality, two shells.

Genus POLINICES Montfort, 1810.

Shell oval elongate, subglobular or depressed, generally smooth, umbilicated or having the umbilicus closed by a callus. Operculum corneous, paucispiral, semilunar, having the nucleus nearly lateral, concave externally.

Subgenus PAYRAUDEAUTIA Bucquoy, Dautzenberg & Dollfus.

Polinices nubila Dall. Plate 58, fig. 6.

Neverita nubila Dall, Blake Report, II, p. 294, 1889.

Shell with four and a half convex whorls which are slightly concave below the suture, with strong growth lines which are somewhat plicate above, but are smoother below; it is also sculptured with exceedingly faint spiral lines; aperture semilunar; columella straight; umbilicus moderately open, surrounded by a revolving ridge at its base, which projects within, partly closing it. Color dirty milky white, faintly clouded with brownish.

Height, 10; diameter, 10 mm.

Mayaguez, Porto Rico; two slightly worn shells; also Barbados and the Gulf of Mexico.

Subgenus MAMMILLA Schumacher, 1817.

Shell rather thin, ovate, with a partially open umbilicus and a conspicuous epidermis when living.

Polinices uberina d'Orbigny.

Natica uberina d'Orbigny, Moll. Cubana, II, p. 31, pl. XVII, fig. 19, 1842.

Shell white, covered with a thin, horn-colored epidermis, subovate; the last whorl large; whorls flattened or slightly excavated above, with very fine growth lines, and sometimes exceedingly faint revolving striæ; aperture semilunar; outer lip thin; columella straight; umbilicus small, situated below the middle of the shell.

Height, 20; diameter, 17 mm.

Mayaguez, Porto Rico; Ensenada Honda, Culebra.

Polinices lactea Guilding.

Naticina lactea Guilding, Linn. Trans., XVII, p. 29, 1833.
Natica lactea Tryon, Man., VIII, p. 49, pl. XVI, figs. 54–57, 1886.

San Juan, Porto Rico (Gundlach).

Extremely close to the preceding species.

Polinices mamillaris Lamarck.

Natica mamillaris Lamarck, An. sans Vert., VI, part 2, p. 197, 1822.
Natica mamillaris Tryon, Man., VIII, p. 43, pl. XVIII, fig. 74, 1886.

Shell solid, conic ovate, the whorls scarcely rounded, flattened or faintly excavated above, with fine growth striæ and still finer revolving lines; umbilicus wide, with a broad entering callus, the columella having an elevated callus above. The upper surface of the shell is chocolate colored and is covered with a thin epidermis; when worn smooth it generally shows faint longitudinal whitish narrow bands or lines; the base of the shell and the columella are white; within the outer lip the external color is seen.

Height, 40; diameter, 31 mm.

Aguadilla, Porto Rico, one young shell.

Genus SIGARETUS Lamarck, 1799.

Shell auriform, depressed, perforate or imperforate, spirally grooved; aperture very large, oval; columellar border regularly arcuate; operculum corneous, small, paucispiral, prolonged below.

Sigaretus martinianus Philippi.

Sigaretus martinianus Philippi, Abbild. und Beschr., I, p. 144, pl. I, fig. 5, 1844.

San Juan, Porto Rico (Gundlach).

Superfamily DOCOGLOSSA.

Family ACMÆIDÆ.

Genus ACMÆA Eschscholtz, 1828.

Shell patelliform, solid, oval or circular, summit anteriorly directed and more or less in front of the middle; interior not iridescent and generally having an internal marginal border of color.

Acmæa candeana d'Orbigny.

Patella candeana d'Orbigny, Moll. Cubana, II, p. 199, pl. XXV, figs. 1-3, 1845.

Shell ovate, depressed, the apex in front of the middle, the slopes convex; surface whitish, finely regularly radiately striate, with radiating dark lines or sometimes broad irregular rays. Inside with a broad, light-colored translucent border, usually showing the outside rays; the central area brownish and often marbled.

Length, 25; breadth, 21; height, 8 mm.

Aguadilla, Porto Rico.

Acmæa punctulata Gmelin.

Patella punctulata Gmelin, Syst. Nat., XIII, pp. 3705, 3717, 1792.
Acmæa punctulata Pilsbry, Man., XIII, p. 37, pl. V, figs. 99-113, 1891.

Shell depressed, oval to nearly round, the apex sharp and subcentral; surface sculptured with low radiating ribs, every third or fourth one being larger. Color yellowish or pinkish, with distinct red dots between the ribs.

Length, 24; breadth, 18; height, 7 mm.

Puerto Real; San Geronimo; Hucares; San Juan, Porto Rico.

Acmæa punctulata var. pulcherrima Guilding.

Smaller, smoother, more depressed, and more delicate than the type.

Puerto Real; Aguadilla, Porto Rico.

Acmæa leucopleura Gmelin.

Patella leucopleura Gmelin, Syst. Nat., XIII, p. 3699, 1792.
Acmæa leucopleura Pilsbry, Man., XIII, p. 40, pl. V, figs. 16-26, 1891.

Shell solid, round-oval, rather sharply conical, though sometimes depressed, with about twelve strong primary ribs and shorter interposed ribs at the base which do not reach the apex. Ribs white, the interstices brown or black.

Length, 20; diameter, 16; height, 8 mm.

One young shell was taken at Hucares, Porto Rico.

Superfamily RHIPIDOGLOSSA.

Family COCCULINIDÆ.

Genus COCCULINA Dall, 1882.

Shell patelliform, not nacreous, colorless, with decussated sculpture, symmetrical, with an entire nonsinuated margin and a posteriorly inclined apex, with a spiral, usually deciduous nucleus; muscular impression horseshoe-shaped, interrupted over the head; radula rhipidoglossate.

Cocculina portoricensis, n. sp. Plate 53, figs. 18, 19.

Shell white, covered with a papery, pale olive-gray periostracum; apex subcentral, minute, hardly prominent; sculpture of rather sparse and feeble radial threads, incremental lines, and an almost microscopic sagrination without definite pattern, but chiefly concentric and occasionally microscopically pustular. Interior white, smooth, the muscular horseshoe-shaped impression very broad and high up in the shell, its anterior end directed in a contrary sense to the apex of the shell.

Length from anterior end to apex, 5.7; of whole shell, 12; breadth, 8; height, 4.7 mm.

Station 6052, San Juan Harbor, Porto Rico, in 310 fathoms.

This species is similar in many respects to the other known members of the genus, and perhaps most like *C. rathbuni*, but has a different sculpture, the *C. rathbuni* showing none of the curious vermiculate or sagrinate markings. The animal is blind, with a large verge projecting from the right tentacle and the ctenidium carried over so that it appears to spring from the right side of the animal. There are two rather long epipodial processes between the mantle and the foot behind.

Family PHASIANELLIDÆ.

Genus PHASIANELLA Lamarck, 1804.

Shell generally imperforate, without epidermis, porcellanous, bulimiform, usually polished and variegated with bright colors. Aperture entire; operculum solid, calcareous, internally paucispiral, with the nucleus near its base, externally white and convex.

Phasianella umbilicata d'Orbigny.

Phasianella umbilicata d'Orbigny, Moll. Cubana, II, p. 77, pl. XIX, figs. 32, 34, 1842.

Shell small, with five to five and a half rounded whorls; suture deep; sometimes sculptured with revolving lines, at others smooth; sometimes the whorls are slightly angular on account of the prominence of one or more of the revolving lines; last whorl obscurely angular below; aperture short, oval; umbilical area perforated. Color whitish, dotted with reddish or brownish, with longitudinal or zigzag reddish or brownish streaks.

Height, 5; diameter, 3 mm.

Vieques, one shell.

Phasianella tessellata Potiez & Michaud.

Phasianella tessellata Potiez & Michaud, Galérie de Douai, I, p. 312, pl. XXIX, figs. 7, 8, 1838.

Shell solid, smooth, ovate; apex obtuse; whorls four or five, somewhat convex, the last large and obtusely angulate on the periphery; aperture oblique, ovate; columella with a white callus; umbilical region excavated, often perforate. Color white, yellow, or reddish, longitudinally clouded with white, red, or brown, encircled with close, narrow, revolving and obliquely descending orange or red lines.

Height, 5.5; diameter, 3 mm.

Mayaguez, Porto Rico, one broken shell.

Family TURBINIDÆ.

Genus TURBO Linnæus, 1758.

Shell turbinate or depressed, nacreous, with or without an umbilicus, the young not carinate or spinose; base convex; operculum flat or concave within, paucispiral, but having a multispiral nucleus, the outside convex, smooth, tuberculate, or with concentric ribs.

Turbo castaneus Gmelin.

Turbo castanea Gmelin, Syst. Nat., p. 3595, 1792.
Turbo castaneus Pilsbry, Man., X, p. 203, pl. XLV, figs. 88–90, 1888.

Shell turbinate, with five to six and a half whorls which are generally rounded, imperforate, and having a round aperture; the sculpture consisting of revolving, nodulous ridges everywhere closely set; two of these on the upper whorls and three on the body whorl are stronger than the rest, and often rise into knobs or vaulted scales, making the shell somewhat angulate. There is often a row of knobs just below the suture; columella thickened and rounded, the base of the shell projecting a little. The color pattern is much diversified, the ground being gray, orange, orange brown or greenish variously blotched with whitish. The operculum is chestnut colored within.

Height, 30; diameter, 23 mm.

Boqueron Bay; Ponce Reefs; Puerto Real; Fajardo; Mayaguez; Catona; San Juan; Guanica, Porto Rico. An abundant, widely distributed form.

Genus ASTRALIUM Link, 1807.

Shell trochiform, more or less flattened below, sometimes depressed above; the young shell is always carinated and spinose at the margin; operculum oval or oblong, with generally submarginal or terminal multispiral nucleus, usually with one to several external ribs.

Astralium cælatum Gmelin.

Trochus cælatus, etc., Chemnitz, Conch. Cab., v, p. 33, pl. CLXII, figs. 1536, 1537.
Trochus cælatus Gmelin, Syst. Nat., p. 3581, 1792.

Shell solid, imperforate, pyramidal, with slightly convex whorls and subcarinate periphery, with flattened base, having immediately below the suture a series of strong, oblique, subradiating ribs, with finer oblique ribs between; the rest of the shell is sculptured with strong, revolving ridges, which are everywhere crossed by oblique, scaly lines of growth. Above the periphery these frequently form vaulted or subtubular processes; aperture very oblique; columella wide, curved, often having one or more grooves on its face. Color dirty white or greenish, radiately maculate with brown.

Operculum oval; nucleus submarginal; the outside convex, white or brown tinted, coarsely granulose. It is much like that of *Turbo*, but the young shells are carinated and usually spiny on the periphery.

Height, 80; diameter, 80 mm.

Guanica; Playa de Ponce; Arroyo, Puerto Real, Porto Rico; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra.

Astralium tuber Linnæus.

Trochus tuber Linnæus, Syst. Nat., ed. x, p. 759, 1758.
Astralium tuber Pilsbry, Tryon's Man., x, p. 223, pl. LVI, figs. 79, 80, 1888.

Shell solid, often rather elevated, with about six flattened or somewhat rounded whorls, sometimes a little shouldered, sculptured by fine and coarse, oblique ridges on the upper part of the whorls; base of the shell somewhat rounded, imperforate; columella wide, often excavated, bituberculate below. Color dirty white or greenish radiately maculate with brown.

Height, 45; diameter, 45 mm.

Guanica; Hucares; San Geronimo, Porto Rico; Caballo Blanco Reef, Vieques; West Indian region generally.

This shell has much the appearance of a *Turbo*, but the young are subspinose at the periphery.

Astralium longispinum Lamarck.

Trochus longispinus Lamarck, An. sans Vert., VII, p. 10, 1822.
Astralium longispina Pilsbry, Tryon's Man., x, p. 221, pl. LI, figs 1-9, 1888.

Shell sublenticular, low, rounded above, less convex, sometimes nearly flat below; whorls six to seven, often obliquely rigid below the sutures, then with several revolving series of granules or vaulted scales; periphery sharply carinate, armed with strong, triangular, flattened spines which extend over the sutures to near the summit of the shell, there being about sixteen on the last whorl; base having strong radiating lamellæ, which cross the five or six revolving tuberculous ridges; aperture transverse, rounded, channeled at the outer edge; umbilical region often excavated, but generally imperforate; aperture and columella silvery. Color white, yellowish, or light brown.

Height, 20; diameter, 37 mm. Another shell, height, 16; diameter, 60 mm.

Mayaguez Harbor; Puerto Real, Porto Rico; Culebra, West Indies; Florida Keys, etc.

Astralium americanum Gmelin.

Trochus americanus Gmelin, Syst. Nat., p. 3581, 1792.
Astralium americanum Pilsbry, Man., x, p. 224, pl. LII, figs. 18-20, 1888.

Shell trochiform, elevated conical, with about nine nearly plane whorls, having the suture well marked, with strong, oblique growth lines, with irregular, obliquely radiate, often curved ridges throughout as far down as the periphery; there is generally a slightly defined revolving ridge just above the suture; aperture oblique, somewhat angulated at the rather sharp periphery, silvery; base with about eight revolving, scaly ridges. Color white or yellowish.

Height, 27; diameter, 27 mm.

Aguadilla, Porto Rico, one young shell; West Indies, Florida Keys.

Family TROCHIDÆ.

Genus CHLOROSTOMA Swainson, 1840.

Shell conical, nacreous, umbilicate or imperforate, solid; aperture oblique, subrhomboid, the outer lip smooth within; columella arcuate, continued over or part way around the umbilicus, which, when open, shows one or more spiral ribs within; base of columella with two or more tubercles; operculum horny, circular, multispiral.

Subgenus OMPHALIUS.

Chlorostoma scalare Anton.

Trochus scalaris Anton (in) Philippi, Abbild. und Beschr., I, *Trochus*, pl. IV, fig. 11, 1844.

Shell trochiform, with pointed summit; whorls seven, rounded or sometimes slightly shouldered, the last subcarinate on the periphery, sculptured with close, revolving threads which are usually subnodulous; some of these threads are stronger than others and cause the shell sometimes to be slightly angular on the upper part of the whorls; aperture oblique; lip thickened; umbilicus wide, with two or three strong, revolving ribs within; columella concave, ending in two or more teeth below. Color grayish or greenish gray, with mottlings of darker color.

Height, 16; diameter, 20 mm.

Playa de Ponce; Puerto Real; Guanica; Arroyo, Porto Rico; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra.

Chlorostoma fasciatum Born.

Trochus fasciatus Born, Mus. Cæs. Vind., p. 331, pl. XII, figs. 3, 4, 1780.

Shell depressed conical, with a somewhat rounded spire and rather blunt apex; whorls rounded below, and flattened or faintly concave above, smooth, with the exception of very faint, wavy, revolving lines and equally faint growth lines; lip thick, sometimes double and faintly ridged within; umbilicus moderate, with one strong ridge within. The shell shows a great variety of coloring; the ground may be yellowish red or various shades of brown, with fine, revolving rows of small, angular white spots. There is generally a light band on the rounded periphery, and there may be blotches or irregular, radiating, whitish flames above.

Height, 12; diameter, 15 mm.

Playa de Ponce; Guanica; Puerto Real; Arroyo, Porto Rico; Ensenada Honda, Culebra.

Chlorostoma excavatum Lamarck.

Trochus excavatus Lamarck, An. sans Vert., VII, p. 29, 1822.
Chlorostoma excavatum Pilsbry, Man., XII, p. 187, pl. LXIII, figs. 3–5, 1899.

Shell trochoidal, sides slightly convex; whorls but little rounded, the last strongly but not sharply carinate at base, sculptured with wide, low, revolving ribs; aperture very oblique; outer lip not much thickened; columella sinuous, scarcely swollen; umbilicus moderate, half surrounded with sickle-shaped callus; base generally concave, with strongly marked, revolving liræ. The apex is usually eroded, the rest of the shell above is grayish or pinkish, with irregular, subradial, broken, brown markings.

Height, 10; diameter, 15 mm.

Aguadilla; Hucares, Porto Rico; Ensenada Honda, Culebra.

The upper half of the shell is generally much eroded.

Chlorostoma maculostriatum C. B. Adams.

Monodonta maculostriata C. B. Adams, Proc. Bost. Soc. Nat. Hist., V, p. 6, 1845.
Chlorostoma maculostriatum Pilsbry, Man., XI, p. 184, pl. XXIV, figs. 88, 89, 1889.

Shell umbilicate, low conical; whorls slightly convex, the last feebly angulate at the base; the surface is covered with fine, but distinct, revolving striæ; base concave around the umbilicus; aperture subquadrate; columella with a callus above and two rather strong teeth below. Color dark green, olivaceous or brownish, more or less dotted with white, sometimes flamulate with white; a light tract at the umbilicus is dotted with brown.

Height, 9; diameter, 10 mm.

Hucares; Arroyo, Porto Rico, one young shell.

Genus LIVONA Gray, 1842.

Shell large, turbinate, solid, the surface mottled; aperture oblique, smooth within; umbilicus large; columella arcuate, with a callus above which extends half way around the umbilicus and is notched in the middle; operculum with very numerous whorls.

Livona pica Linnæus.

Turbo pica Linnæus, Syst. Nat., X, p. 763, 1758.
Livona pica Pilsbry, Man., XI, p. 277, pl. LXI, fig. 24, 1889.

Shell large, solid, conical, with about six rounded whorls, the surface generally slightly corrugated; aperture suborbicular, oblique, umbilicus rather wide; operculum circular, multispiral, often with a large green patch. Shell whitish or greenish, with maculations or zigzag stripes of black; often the whole of the upper surface is nearly or entirely black.

Height, 70; diameter, 80 mm.

San Geronimo; Cabo Rojo light; Aguadilla; Ponce; Hucares; San Juan; Guanica, Porto Rico; Caballo Blanco Reef, Vieques.

This beautiful species is extremely abundant on the coral rocks of the entire West Indian region, and is used for food in many places. The operculum is a lovely object.

Genus MICROGAZA Dall, 1881.

Shell flattened, rotelliform, nacreous within and without, umbilicated; lip thin; columella without a callus.

Microgaza rotella Dall.

Microgaza rotella Dall, Bull. Mus. Comp. Zool., IX, p. 51, 1881; XXIX, p. 357, pl. XXII, figs. 5, 5*a*, 1889.

Shell depressed, lenticular; whorls about five, the earlier two or three rounded, the apex elevated; at the suture of the later whorls there is an elegant row of small nodules; last whorl subcarinate on the periphery; umbilicus wide, bounded at its edge by a sharp, crenated angle; aperture nearly semilunar; columella short, nearly straight. The shell sometimes has traces of very fine, revolving threads. It is beautifully iridescent throughout and is often marked with zigzag brown flames.

Diameter, 6; height, 4 mm.

Aguadilla; Mayaguez, Porto Rico.

Genus SOLARIELLA Searles Wood, 1842.

Shell umbilicated, conical; whorls with spiral granose liræ; umbilicus with a carinated margin.

Type, *S. carinata* S. Wood.

Solariella amabilis Jeffreys.

Trochus amabilis Jeffreys, Brit. Conch., III, p. 300, 1865; V, pl. LXI, fig. 6.

Shell pyramidal, pearly, somewhat iridescent, with two spiral ridges on the upper part of the last three or four whorls, with several finer irregular ridges on the base of the shell; the suture is deep and narrow, and below it on the sloping shoulder are numerous radiating ridges; aperture small, nearly round, the last whorl but slightly joined to the penultimate whorl; umbilicus rather large, funnel-shaped.

Height, 8; diameter, 7 mm.

Mayaguez, Porto Rico, one broken shell.

Genus CALLIOSTOMA Swainson, 1840.

Shell generally imperforate, conical, rather thin; whorls smooth, spirally ridged or granular, the last generally angular at the periphery; aperture subquadrangular; columella generally ending in an obscure tooth.

Type, *Trochus zizyphinus* Linnæus.

Calliostoma jujubinum Gmelin.

Trochus jujubinus Gmelin, Syst. Nat., p. 3570, 1792.
Calliostoma jujubinum Pilsbry, Man., XI, p. 404, pl. XL, fig. 16, 1889.

Shell pyramidal, rather solid, with nearly flat whorls, the last roundly carinate below. They are generally a little concave and swollen on the base and are sculptured with numerous spiral, beaded liræ, with finer beaded threads between; aperture subquadrate; umbilicus narrow, slightly funnel-shaped. The lip is generally lirate within. Color chestnut or purple brown, with narrow curved longitudinal white streaks, the base generally dotted with white.

Height, 33; diameter, 26 mm.

Mayaguez, Porto Rico, the lower part of a shell of one of the varieties.

Calliostoma jujubinum var. rawsoni Dall.

Calliostoma jujubinum var. *rawsoni* Dall, Blake Report, II, p. 369, 1889.

Smaller, with narrower umbilicus; columella thin, and the tooth which is found in the type is weak or absent. Shell more conical than the type and much darker in color.

Vieques, one shell.

Family LIOTIIDÆ.

Genus LIOTIA Gray, 1842.

Shell turbiniform or discoidal, longitudinally ribbed or clathrate; aperture slightly nacreous, with continuous peristome, which is thickened and callous. Operculum multispiral, corneous, hispid, with a calcareous layer of pearly particles spirally disposed.

Liotia gemma Tuomey & Holmes.

Trochus gemma T. & H., Pleioc. Fos. S. Car., p. 118, pl. XXVI, fig. 4, 1856.
Architectonica tricarinata Stearns, Proc. Bost. Soc. Nat. Hist. for 1872, p. 23.

Shell low conical, with four whorls, which are sloping above and have on the wide periphery three revolving carinas; these carinas are slightly beaded; there is a revolving row of beads just below the deep suture; there are on the body whorl additional fine beaded ridges; aperture round, the lip but slightly thickened, with a sulcus separating it from the previous whorl; umbilicus moderate, with a beaded carina. Surface whitish pink or purplish, maculated with darker color. There is a row of reddish spots on the lower peripheral carina.

Diameter, 3; height, 2 mm.

Mayaguez, Porto Rico, one slightly broken and worn shell.

Family VITRINELLIDÆ.

Genus LEPTOGYRA Bush, 1897.

Shell minute, dull, dirty white or pale brown, covered with a thin straw-colored epidermis; whorls few, convex; spire elevated, with twisted nuclear whorl; umbilicus large; aperture very oblique; lip simple, continuous.

Leptogyra inconspicua Bush.

Leptogyra inconspicua Bush,? Trans. Conn. Acad. Sci., x, p. 137, 1897.

Shell with two and a half whorls, with low obtuse apex; surface nearly smooth, with microscopic growth lines and ill-defined wrinkles extending from the suture some distance down the shell.

Diameter, 1.3; height, 1.8 mm.

Mayaguez, Porto Rico, one young shell, of which the identification is doubtful.

Family NERITIDÆ.

Genus NERITA (Linnæus, 1758) Lamarck, 1799.

Shell imperforate, globular or oval, solid, smooth or with spiral sculpture; spire short; aperture semilunar, entire; lip thick, generally toothed within; columellar area large, flattened, often sculptured, its border dentate. Operculum calcareous, the external face granulous or sculptured, paucispiral; nucleus excentric; internal face callous; apical and claviform apophyses well developed.

Nerita peloronta Linnæus.

Nerita peloronta Linnæus, Syst. Nat., x, p. 778, 1758.
Nerita peloronta Reeve, Conch. Icon., IX, pl. II, figs. 8, 8*b*, 1855.

Shell with a sharp-pointed spire and somewhat rounded whorls, the last concave just below the shallow suture; sculptured with revolving ridges which are strong and sharp on the earlier whorls but which become rounded and rather faint toward the aperture; within the lip there are two teeth above, a larger and a smaller, and one at the base, and between these there are vestigial teeth; there are two strong teeth on the columella, the upper the larger; the columellar face is slightly ridged, and at its upper termination there is a small canal. Color whitish, yellowish, or purplish, variously mottled and zigzagged with red or black. The columellar area is stained red as if with blood, hence the popular name "Bleeding tooth shell."

Height, 40; diameter, 45 mm.

San Juan; Hucares; Aguadilla, Porto Rico; Culebra Island.

Nerita tessellata Gmelin.

Nerita tessellata Gmelin, Syst. Nat., p. 3685, 1792.
Nerita tessellata Reeve, Conch. Icon., IX, pl. IX, figs. 43, 43*a*, 1855.

Shell with rather low bluntly pointed spire and from three to three and a half whorls which are scarcely convex, the last flattened or a little concave above; the sculpture consists of strong, rounded ridges throughout; lip thick, grooved within, with two teeth above; columellar area excavated pustulous; outline of columella somewhat incurved, with one or two faint teeth in middle. Color white, tessellated with black. Sometimes the entire shell is black, with a few white markings; interior bluish.

Height, 20; diameter, 17 mm.

This abundant species was taken at thirteen different stations about Porto Rico; West Indies; Florida Keys.

Nerita tessellata var. præcognita C. B. Adams.

Nerita præcognita Reeve, Conch. Icon., IX, pl. VII, figs. 30*a*, 30*b*, 1855.

In the variety the spire is generally lower than in the type, the columella is straighter and more strongly toothed, and the area is less excavated.

Height, 20; diameter, 23 mm.

Culebra, four shells.

Nerita versicolor Lamarck.

Nerita versicolor Lamarck, An. sans Vert., VI, p. 193, 1832.
Nerita versicolor Reeve, Conch. Icon., IX, pl. XII, figs, 56, *a*, *b*, *c*, *d*, 1855.

Shell with a somewhat elevated, pointed spire, the last whorl slightly concave below the suture; sculptured with strong, revolving ridges throughout; aperture crescentic; lip within with one strong tooth above and one below, with a row of smaller ones between; columellar area full or flat, wrinkles, which are slightly pustulous; columella convex, with four strong teeth. Color of the ground whitish, often brilliantly tinted with red; ribs marked with square or elongated violet or black spots.

Height, 20; diameter 17 mm.

Found abundantly at nearly all the stations around Porto Rico.

Genus NERITINA Lamarck, 1809.

Shell relatively thin, subglobose or oval, whorls generally smooth, sometimes rough or spinose; aperture semicircular; columellar border straight, finely toothed or smooth; lip sharp, not toothed or ridged within; operculum shelly, with a flexible border, exhibiting two processes which have been called a rib and a peg.

Neritina reclivata Say.

Neritina reclivata Say, Journ. Acad. Nat. Sci. Phila., III, 1822, p. 257.
Neritina reclivata Tryon, Man., X, p. 39, pl. XII, figs. 25–30, 1888.

Shell globosely conical; spire somewhat produced but obtuse; whorls concavely slanting on the shoulder; suture well defined; aperture semilunar, patulous; inner lip nearly straight, faintly toothed in the middle. Color olivaceous, greenish, or brownish, with oblique, undulating dark lines which are sometimes reticulated. Height, 20; diameter, 7 mm. Vieques, one worn shell.

Neritina virginea Linnæus.

Nerita virginea Linnæus, Syst. Nat., ed. X, p. 778, 1758.
Neritina virginea Reeve, Conch. Icon., IX, pl. XXI, fig. 92, *a* to *d*. 1855.

Shell smooth, polished, usually white, sage colored, yellowish, or violaceous, with a fine, close pattern of parallel, longitudinal darker or lighter lines; these sometimes are reticulated, or give the markings the appearance of scales on a fish. The shell may be variously spotted or zoned; in fact there is an endless variety in coloring. The spire is generally low or only moderately developed and obtuse; the whorls below the suture are usually a little sloped, the lip is sharp, the columella is straight, with a number of rather strong teeth.

Diameter, from 6 to 20 mm.; height about the same as the diameter, sometimes a little greater.

San Juan; Mayaguez, Porto Rico; a number of shells.

Neritina viridis Linnæus.

Nerita viridis Linnæus, Syst. Nat., ed. X, p. 778, 1758.
Neritina (*Smaragdia*) *viridis* Tryon, Man., X, p. 54, pl. XVIII, fig. 88, 1888.

Mayaguez, Porto Rico, one dead specimen.

Family HELICINIDÆ.

Shell turbinated, heliciform, or globular; spire short; aperture semicircular; interior walls absorbed by the animal; operculum horny or calcareous, nonspiral.

Genus HELICINA Lamarck, 1799.

Shell imperforate, having a callus on the inner wall of the aperture; whorls few, peristome thickened, reflected; operculum corneous or shelly.

Type, *H. neritella* Lamarck.

Helicina vinosa Shuttleworth.

Helicina vinosa Shuttleworth, Diagn. neue Moll., 1854, p. 92.
Helicina vinosa Sowerby, Conch. Icon., XIX, pl. XIV, fig. 118, *a*, *b*, 1873.

Porto Rico; Vieques.

Helicina umbonata Shuttleworth.

Helicina umbonata Shuttleworth, Diagn. neue Moll., p. 93, 1854.

Porto Rico.

Helicina hjalmarsoni Pfeiffer.

Helicina hjalmarsoni Pfeiffer, Mal. Blätt., III, 1856, p. 50.
Helicina hjalmarsoni Sowerby, Conch. Icon., XIX, pl. XXV, fig. 223, 1873.

Arecibo; Ponce; near Utuado, Porto Rico.

Helicina striata Lamarck.

Helicina striata Lamarck, An. sans Vert., VI, p. 103, 1822.
Helicina striata Sowerby, Conch. Icon., XIX, pl. XXII, fig. 191, 1873.

Porto Rico, several localities.

Helicina subfusca Menke. Plate 54, fig. 6.

Helicina subfusca Menke, Synopsis, 1828, p. 79.

Shell depressed globose, with distinct growth striæ, amber colored to brownish; whorls five and a half, nearly flat or sometimes having a faint revolving depression at some distance below the suture; suture distinct but not deep; periphery rounded or slightly subcarinate; aperture semicircular, outer lip sharp; basal callus granular.

Height, 7; diameter, 9 mm.

Under rocks in pastures, Bayamon, Porto Rico, and also at St. John and St. Thomas.

Helicina fasciata Lamarck.

Helicina fasciata Lamarck, An. sans Vert., VI, p. 103, 1822.
Helicina fasciata Sowerby, Conch. Icon., XIX, pl. IX, fig. 73, 1873.

Porto Rico; St. John; possibly found in some of the Lesser Antilles.

Helicina phasianella Sowerby.

Helicina phasianella Sowerby in Pfeiffer, Mal. Blätt., III, p. 50, 1856.
Helicina phasianella Sowerby, Conch. Icon., XIX, pl. XXX, fig. 270, 1873.

Vega Baja; Aguadilla, Porto Rico; Vieques.

Helicina trochulina d'Orbigny.

Helicina trochulina d'Orbigny, Moll. Cubana, I, p. 249, pl. XX, figs. 10, 12, 1841.
Helicina trochulina Sowerby, Conch. Icon., XIX, pl. XVI, fig. 138, 1873.

Porto Rico.

Helicina foveata Pfeiffer.

Helicina foveata Pfeiffer, P. Z. S., 1853, p. 35.

Vieques; St. Thomas.

Genus STOASTOMA C. B. Adams, 1849.

Stoastoma portoricense Pfeiffer.

Stoastoma portoricense Pfeiffer, Mal. Blätt., III, p. 51, 1856.

Manati, in the Delicias plantation, Porto Rico.

Superfamily ZYGOBRANCHIA.

Family FISSURELLIDÆ.

Subfamily FISSURELLINÆ.

Genus FISSURELLA Bruguière, 1791.

Subgenus FISSURELLA s. s.

Shell conical, its base oval or elliptical; apex spiral in the young, removed in the adult, having a rounded or elliptical anal opening which is bounded inside by a callus with entire margins, not truncate or excavated behind. Shell capable of containing the entire animal.

Section CREMIDES H. & A. Adams.

Fissurella barbadensis Gmelin.

Patella barbadensis Gmelin, Syst. Nat., p. 3729, 1792.
Fissurella barbadensis Pilsbry, Man., XII, p. 164, pl. XXXVII, figs. 40–49, 1890.

Shell solid, low, conical, with ovate base; apex subcentral, with rounded opening. Surface sculptured with radiating ribs; eleven of these are generally stronger, and all are more or less rudely scaly. Color whitish, variegated with brown or purplish markings; interior generally greenish, often zoned.

Greatest length, 38; breadth, 26; height, 15 mm.

San Juan; San Geronimo; Ponce; Aguadilla; Guanica, Porto Rico; West Indies; Florida Keys.

The species is variable in the degree of elevation, sculpture, and in coloring, and very abundant. One shell from San Geronimo measures as follows: Length, 26; breadth, 15; height, 6 mm.; and the principal ribs are white.

Fissurella rosea Gmelin.

Patella rosea Gmelin, Syst. Nat., p. 3730, 1792.
Fissurella rosea Pilsbry, Man., XII, p. 166, pl. LXII, figs. 19–21, 1890.

Shell rather thin, low, conical, ovate, narrowed in front; apex a little in front of the middle of the shell; anal perforation elliptical; surface sculptured with numerous low, rounded, sometimes slightly scaly riblets; internal callus not inflated. Color grayish, with ten to twelve broad, purple rays; sometimes almost the entire surface is purplish; interior greenish, often purple or rose-tinted.

Length, 26; diameter, 18; height, 7 mm. San Geronimo; Aguadilla, Porto Rico.

This species is close to *F. barbadensis*, but is a thinner, more delicate, and generally smoother form.

Fissurella nodosa Born.

Patella nodosa Born, Mus. Cæs. Vind., p. 429. 1780.
Fissurella nodosa Pilsbry, Man., XII, p. 164, pl. XXXVII, figs. 46–48, 1890.

Shell oval, solid, conical, considerably elevated; apex subcentral, with a keyhole-shaped orifice; surface sculptured with strong, radiating, nodose ribs. Color uniform brownish or white. The internal callus is distinctly marked but not swollen, and from it there are generally faint radiating grooves that mark the position of the ribs.

Length, 30; breadth, 22; height, 17 mm.

San Geronimo; San Juan; Aguadilla, Porto Rico; West Indian region generally.

Subgenus CLYPIDELLA Swainson.

Fissurella fascicularis Lamarck.

Fissurella fascicularis Lamarck, An. sans Vert., VI, p. 14, 1822.
Fissurella fascicularis Pilsbry, Man., XII, pl. 177, p. XXXVII, figs. 59, 60, 1890.

Shell depressed, oval, moderately solid, the ends slightly raised; orifice somewhat cross-shaped, elongated, narrow, and with a wider area in the middle; surface sculptured with numerous fine, radiating, roughened, or nodulous ribs which are reddish brown or crimson, usually darker than the intervening spaces; within the border is thickened and nearly smooth; the callus is distinct and radiately ridged and the color is pink, purplish, and whitish, often shaded green.

Length, 21; diameter, 17; height, 6 mm. San Juan; San Geronimo, Porto Rico.

A lovely, somewhat saddle-shaped species, close to and easily mistaken for *F. pustula* Lamarck. The latter, however, is decidedly truncated in front, while the species under consideration is rounded.

Subfamily FISSURELLIDINÆ.

Genus LUCAPINELLA Pilsbry, 1890.

Shell oblong, depressed, narrowed in front, cancellated; apex with a large opening, which is margined within by a strong, entire, nontruncate border. The shell characters are essentially the same as in *Fissurella*, the differences between the two genera being mostly anatomical.

Type, *Clypidella callomarginata* Carpenter.

Lucapinella limatula Reeve.

Fissurella limatula Reeve, Conch. Icon., *Fissurella*, fig. 115, 1850.

Shell oblong, narrowed and rounded in front, depressed, the summit subcentral, with a large opening of the same shape as the shell; surface sculptured with alternately larger and smaller radiating ribs; sometimes there are two or three small ribs between the larger ones, and all are crossed by regular concentric laminæ which rise into erect scales over the ribs; white or rayed with ashen purple or blackish. The callus around the opening is heavy and continuous.

Length, 26; breadth, 15; height, 6 mm.

Catano; Mayaguez Harbor, Porto Rico.

One specimen of the dimensions given above came from the former locality.

Genus LUCAPINA Gray, 1857.

Shell oblong oval, embedded in mantle but covering most of the animal; apex in front of middle, having a large oval perforation; edges of shell not thickened, regularly and finely crenulated.

Section CHLAMYDOGLYPHIS Pilsbry, 1890.

Lucapina adspersa Philippi.

Fissurella adspersa Philippi, Abbild. und Beschr., II, p. 34, pl. I, fig. 3, 1845.

Shell oblong, depressed, conical, narrower in front, the sides a little convex, the apex in front of the middle of the shell; surface sculptured with radiating, alternately larger and smaller ribs, which are crossed by strong, concentric, regular ridges; perforation oval, much the shape of the shell; inner border strongly crenulate, the teeth arranged in pairs; callus strong, swollen, truncated behind, and having a greenish streak along each side. Color whitish or pale brownish, with from seven to nine broad rays of darker color; bluish white within, showing the rays.

Length, 21; breadth, 11; height, 5 mm.

San Geronimo, one shell, not adult.

Lucapina cancellata Sowerby.

Fissurella cancellata Sowerby, Conch. Ill., fig. 29, 1839.

Shell oblong, scarcely narrowed in front, low conical, sculptured with numerous radiating ribs which are alternately larger and smaller, and strong, regular, concentric threads, which form flattened nodules where they cross the ribs; orifice rather large in front of the middle, long oval, stained blue black; inside white, the callus bluish black, slightly truncate behind. Color white throughout or faintly rayed or flecked with brown.

Length, 25; breadth, 15; height, 7 mm.

One fine alcoholic specimen was obtained from the reefs at Ponce.

Subfamily EMARGINULINÆ.

Genus FISSURIDEA Swainson, 1840.

Shell ovate, conical, the orifice in front of the middle; apex spiral, inclined backward when young; surface cancellated; internal opening having a strong callus within, which is truncated behind or has a pit. The shell characters of several of the genera of the *Fissurellidæ* are not well differentiated, the classification being based largely on the anatomy.

Fissuridea listeri d'Orbigny.

Fissurella listeri d'Orbigny, Moll. Cubana, II, p. 197, pl. XXIV, figs. 37-39, 1845.

Shell solid, conic, moderately elevated; sides nearly straight; sculpture consisting of radiating ribs which are alternately larger and smaller; sometimes there are three sets of them of different sizes;

they are crossed by concentric ridges which are often nodose at the crossings; perforation keyhole-shaped, bounded by a black line without and a callus within that is distinctly truncated behind; inner edge of the shell toothed, and from the edge there are grooves running inward that mark the place of the ribs; white within the hole, callus sometimes bounded with a dark line; the outside of the shell is whitish, unicolored, or with radial dark stripes.

Length, 35; breadth, 26; height, 15 mm.

San Juan; San Geronimo, Porto Rico.

Fissuridea alternata Say.

Fissurella alternata Say, Journ. Acad. Nat. Sci., Phila., II, p. 281, 1822.
Glyphis alternata Pilsbry, Man., XII, p. 211, pl. XXXVII, figs. 50–53, 1890.

Shell oval, elevated, conical; front slope straight or concave; back slope generally convex; surface closely sculptured by radiating ribs, of which three are small and every fourth one is larger; these are crossed by fine, concentric laminæ which form little scales where they pass over the ribs. Color white, grayish, or yellowish, radiately marked with pink, brown, or black stripes which are often somewhat broken. The summit is in front of the middle, more or less inclined forward; opening keyhole-shaped, the front part of it appearing as if it had been broken away for some distance down the shell. Inside white; margin toothed.

Length, 36; breadth, 22; height, 16 mm.

Ensenada Honda, Culebra.

Fissuridea alternata var. **dysoni** Reeve.

Fissurella dysoni Reeve, Conch. Icon., VI, fig. 63.

A form with very strong, sharp sculpture and intensely black, broken. radiating stripes, which become brownish at the base of the shell.

Ensenada Honda, Culebra.

Fissuridea alternata var. **sayi** Dall.

Fissurella alternata var. *sayi* Dall, Blake Report, II, p. 407, 1889.

This form differs from the *F. alternata* of Say in being smaller and generally without color or only having a faint olivaceous tint and in having a more delicate shell.

Mayaguez, Puerto Real, Porto Rico.

Fissuridea variegata Sowerby.

Fissurella variegata Sowerby, Thes. Conch., p. 200, figs. 172, 173.

Shell small, oblong, depressed, back slope a little rounded, front slope nearly straight, sculptured with alternating, radiate ribs and strong concentric threads; opening long, somewhat cross-shaped. Interior toothed at border. The ground is whitish, and there are about seven wide bottle-green or brownish radiating stripes which do not reach the summit, and these show through on inside of shell.

Length, 10; breadth, 5; height, 2.5 mm.

Mayaguez Harbor, one immature shell.

Fissuridea viridula Lamarck.

Fissurella viridula Lamarck, An. sans Vert., VI, p. 13, 1822.
Glyphis viridula Pilsbry, Man., XII, p. 226, pl. LXII, figs. 22–25, 1890.

Mayaguez; Aguadilla, Porto Rico (Gundlach).

Genus SUBEMARGINULA Blainville, 1825.

Shell round-oval, conical; apex near the middle, curved backward; surface radiately ribbed; anal notch generally short, continuing upward as a groove inside, the groove covered by a prominent rib outside; muscle scar horseshoe-shaped, its anterior ends recurved and pointed towards the summit of the shell.

Subemarginula octoradiata (Gmelin) A. Adams.

Patella octoradiata Gmelin (part), Syst. Nat., p. 3699, 1792.
Subemarginula octoradiata Pilsbry, Man., XII. 273, pl. XXIX, figs. 17, 18, 37, 1890.

Shell oval, solid, conical; apex subcentral, inclined backward and to the right; there are eight principal radiating ribs with smaller intermediate ones which are generally roughly nodulous. Whitish without, olive or brownish green, sometimes bluish within. Anterior groove narrow; border toothed.

Length, 23; breadth, 20; height, 10 mm. San Geronimo; Ponce; Fajardo; San Juan, Porto Rico.

Subemarginula notata Linnæus.

Patella notata Linnæus, Syst. Nat., ed. x, p. 784, 1758.
Subemarginula notata Pilsbry, Man., XII, p. 282, pl. LXIV, figs. 34, 35, 1890.

San Juan, Porto Rico (Gundlach).

Subemarginula rollandii Fischer.

Emarginula rollandii Fischer, Journ. de Conchy., v, p. 356, pl. XII, fig. 10, 1856.

Shell small, oval, with the apex subcentral, recurved, sculptured with unequal, radiating ribs, and crossed by coarse, low, concentric cords; anterior fissure deep, straight, its sides nearly parallel. Color white, greenish or pinkish; interior whitish, with white rays.

Length, 8; width, 6.5; height, 3 mm.

Ensenada Honda, Culebra, one specimen.

Subclass AMPHINEURA.

Order POLYPLACOPHORA.

Mollusks whose dorsal surface bears eight imbricating shelly plates embedded in an outer zone or girdle; head divided from the body; gills numerous, occupying a groove on each side between the foot and mantle; foot adapted to creeping.

Family LEPIDOPLEURIDÆ.

Genus LEPIDOPLEURUS Risso, 1826.

Girdle with minute, gravelly, smooth or striated scales, usually with a fringe of longer scales, valves without insertion plates, or with the inserted margin entire.

Lepidopleurus pergranatus Dall. Plate 58, figs. 1, *a–c*.

Leptochiton pergranatus Dall, Blake Report, II, p. 414, 1889.

Shell elongated, slightly elevated, regularly arcuate, without a jugum; valves wide, without apices; front and back valves more or less concave; posterior valve without elevated apex. The whole surface of the shell is covered with close, granular sculpture; the lateral areas slightly raised, and in addition to the granulation sculptured with curved furrows which become fainter on the central areas and are carried around parallel with the sides and back of the valves. Girdle wide, covered with delicate scales; entire shell waxen or white.

Length, 12; breadth, 6.5 mm.

Off San Juan, Porto Rico; also near Dominica, in 138 fathoms.

Family CHITONIDÆ.

Subfamily ISCHNOCHITONINÆ.

Genus CHÆTOPLEURA Shuttleworth, 1853.

Valves external, having sharp, slit insertion plates (at the place of insertion of the girdle); girdle leathery, more or less hairy; gills extending almost or entirely to the front end of the foot.

Chætopleura janeirensis Gray.

Chiton janeirensis Gray, Spic. Zool., p. 6, pl. III, fig. 8, 1828.

Shell oblong, elevated, rather narrow; dorsal ridge somewhat angular, ashen, olive or brownish, strongly sculptured; the mucro in front of the middle, rather prominent; lateral areas strongly elevated, sculptured, with four coarse, granose ribs; anterior valve having eleven to eighteen such ribs; central areas with about twelve granose, acute threads on each side of the jugum; girdle with a few short, delicate hairs.

Length, 18; diameter, 9 mm.

Ensenada Honda, Culebra.

Genus ISCHNOCHITON Gray, 1847.

Valves external, with sharp, slit insertion plates, the teeth not buttressed. Eaves generally solid; girdle covered with imbricating scales, flat or convex, smooth or striated.

Subgenus STENOPLAX Carpenter, 1878.

Ischnochiton limaciformis Sowerby.

Chiton limaciformis Sowerby, P. Z. S., 1832, p. 26.
Ischnochiton limaciformis Pilsbry, Man., XIV, p. 57, pl. XVI, figs. 9–16, 1892.

Shell elongated, narrow, elevated, buff gray, or greenish, marbled indistinctly with darker color, occasionally blotched with red, longitudinally costellate but not granose; girdle scales minute; sculpture of the central areas consisting of fine, smooth longitudinal riblets; these continue on the lateral areas, becoming broader and flat, and are waved on the slope between the two areas. End valves sculptured with close, flattened, concentric ridges, which are somewhat wavy.

Length, 35; breadth, 12 mm.

Ponce Reefs, Porto Rico.

Ischnochiton purpurascens C. B. Adams.

Chiton purpurascens C. B. Adams, Proc. Bost. Soc. Nat. Hist., 1845, p. 9.
Ischnochiton purpurascens Pilsbry, Man., XIV, p. 58, pl. XVII, figs. 23, 24, 1892.

Eastern Porto Rico (Gundlach).

Ischnochiton floridanus Pilsbry.

Ischnochiton floridanus Pilsbry, Man., XIV, p. 58, pl. XVII, figs. 19–22, 1892.

Shell elongated, narrow, elevated, the valves roundly arched, not carinated; lateral areas raised, longitudinally costellate, the riblets cut into granules by radiating, impressed lines over the whole area or the forward part of it. End valves cut into granules; central areas longitudinally ribbed; posterior valve large, rather depressed, the mucro slightly posterior; girdle delicately marbled with bluish and gray, densely covered with rounded, solid, striated scales. Color whitish or pale green, variously mottled with olive, blackish, or gray.

Length, 35; breadth, 11.5 mm.

Ensenada Honda, Culebra, one small specimen.

Subgenus TRACHYDERMON Carpenter, 1863.

Ischnochiton liozonis, n. sp.

Animal small, girdle nearly smooth, reddish brown; valves dark red, more or less flecked with white, or white and gray; surface of the valves nearly smooth, minutely granulose, the granules more evident on the lateral areas which are slightly raised; anterior valve small, with ten slits, above with some obscure radiating ridges; middle valves with moderately prominent mucro, wide dorsal angle, no radial sculpture, the insertion plates with one slit, interior of valve pinkish white, sinus wide, the valve callus forming a strong bow-shaped ridge; posterior with a moderately elevated mucro, narrower sinus, ten or eleven slits, the tegmentum much the shape of a watermelon seed. Gills median.

Length, about 10; width, about 7 mm.

Ensenada Honda, Culebra; Porto Rico, two specimens.

Subgenus ISCHNOCHITON Gray.

Ischnochiton striolatus Gray.

Chiton striolatus Gray, Spic. Zool., p. 6, 1828.
Chiton striolatus Reeve, Conch. Icon., *Chiton*, pl. XXII, fig. 144, 1847.

Shell oblong, the back distinctly or faintly keeled, side slopes convex. Surface apparently smooth, the lateral areas moderately distinct, somewhat raised, sculptured longitudinally with narrow zigzag grooves; central areas having excessively fine quincuncial granulation; end valves with concentric, zigzag grooves and minute granulation; girdle whitish, clouded blue with orange flecks generally, and densely covered with striate scales. Color variable, usually olive green, slaty or cream-colored, more or less mottled.

Length, 14; breadth, 8 mm.

Arroyo; Ponce, Porto Rico; Ensenada Honda, Culebra.

Ischnochiton striolatus var. **funiculatus** Carpenter.

Ischnochiton funiculatus Carpenter MS.

One specimen was taken at Puerto Real which is probably this. Mr. Pilsbry regards it as a variety of *I. striolatus* Gray.

Ischnochiton papillosus C. B. Adams.

Chiton papillosus C. B. Adams, Proc. Bost. Soc. Nat. Hist., 1845, p. 9.
Ischnochiton papillosus Pilsbry, Man., XIV, p. 114, pl. XXI, figs. 40, 41, 1892.

Shell small, oval, carinated, the side slopes faintly convex; surface not divided into distinct areas, apparently smooth but really closely granulate throughout. Color whitish, mottled with olive green, or uniform greenish or brownish.

Length, 8; breadth, 5 mm.

Ensenada Honda, Culebra.

Ischnochiton reticulatus Reeve.

Chiton reticulatus Reeve, Conch. Icon., pl. XV, fig. 83, 1847.

Eastern Porto Rico (Gundlach).

Subfamily CHITONINÆ.

Genus CHITON Linnæus, 1758.

Valves wholly external, the beak of the tail valve median or anterior; insertion plates longer than the eaves, slit into deeply and finely pectinated teeth. Girdle covered with closely imbricating convex, smooth, or striated scales.

Chiton tuberculatus Linnæus.

Chiton tuberculatus Linnæus, Syst. Nat., ed. X, p. 667, 1758.
Chiton tuberculatus Pilsbry, Man., XIV, p. 153, pl. XXXIII, figs. 58–60, 1892.

Shell oval-oblong, rather elevated, carinated; the side slopes nearly straight; lateral areas raised, sculptured with about five cord-like, radiating riblets, which are usually interrupted and broken and bear low tubercles; central areas smooth along the ridge, the sides sculptured with longitudinal riblets curving inward; end valves closely tuberculate.

Color varying from light olive to dark green, sometimes unicolored, generally speckled on the side areas and end valves; some of the valves have a dark stripe on the ridge.

Length, 60; breadth, 33 mm.

Hucares; San Juan; Ponce Reefs; Aguadilla; Guanica, Porto Rico; Caballo Blanco, Vieques.

Chiton tuberculatus var. **assimilis** Reeve.

Chiton assimilis Reeve, Conch. Icon., pl. XIV, fig. 76 (right-hand figure), 77*b*, 1847.

Fawn-colored, with white dots on the lateral areas; carina banded with brown; girdle light green; central areas sculptured with fine, close riblets.

Guanica, Porto Rico.

Chiton squamosus Linnæus.

Chiton squamosus Linnæus, Mus. Ludov. Ulricæ, p. 465, 1764.
Chiton squamosus Pilsbry, Man., XIV, p. 155, pl. XXXV, figs. 80–82, 1892.

Shell oblong, elevated or depressed, carinated, the side slopes somewhat convex; surface of lateral areas minutely beaded; central area smooth, lusterless. Color buff, the central areas regularly and conspicuously striped longitudinally with gray or black.

Length, 60; breadth, 32 mm.

Aguadilla; San Juan; Hucares, Porto Rico.

Chiton viridis Spengler.

Chiton viridis Spengler, Skriv. af Nat. Selsk., IV, p. 70, pl. VI, fig. V, 1797.

Shell oval, somewhat elevated and carinated, side slopes slightly convex; lateral areas strongly raised, sculptured with three or four low, radiating ribs, bearing low, rounded pustules, sometimes without radiating ribs; central areas smooth in the middle but sculptured along the diagonal lines with

S-shaped ribs; end valves with radiating series of tubercles, which are sometimes scattered. Color gray-white to olive, irregularly marked on central areas or ridge with blackish; sometimes all blackish.

Length, 36; breadth, 22 mm.

Ponce Reefs, Porto Rico, one specimen.

Chiton marmoratus Gmelin

Chiton marmoratus Gmelin, Syst. Nat., p. 3205, 1792.
Chiton marmoratus Pilsbry, Man., XIV, p. 158, pl. XXXIV, figs. 72-76, 1892.

Shell oval, rather elevated; dorsal ridge round-angular to carinate; side slopes convex or straight; surface smooth, polished; lateral areas a little raised. Color olive to dark brown or purple brown, variously marked with darker blotches and longitudinal lines; girdle blotched alternately green and light blue.

Length, 56; breadth, 32 mm.

Guanica; Aguadilla; San Juan, Porto Rico.

Genus ACANTHOPLEURA Guilding.

Valves exposed, beaked, generally lusterless or eroded; provided with eyes on the forward part of the lateral areas and the end valves; insertion plates all conspicuously pectinated outside; girdle thick, covered with calcareous spines.

Acanthopleura granulata Gmelin.

Chiton granulatus Gmelin, Syst. Nat., p. 3205, 1792.
Acanthopleura granulata Pilsbry, Man., XIV, p. 227, pl. L, 1892.

Shell large, oblong, moderately elevated or roundly arched; valves solid, with faintly marked lateral areas, granulated all over; the color is generally ashy or brownish, usually darker on the ridge; girdle wide, composed of various-sized spines, looking like a growth of very fine lichens, ashy, blotched with brownish or blackish.

Length, 65; breadth, 38 mm.

One of the most abundant of American chitons, found on almost every rocky coast from lower Florida to northern South America. The valves are almost invariably eroded, even in young specimens, so that little or no sculpture can be seen. The material collected by the *Fish Hawk* expedition was taken at nearly every locality visited in Porto Rico and on the island of Culebra.

Acanthopleura granulata var. **mucronulata** Shuttleworth.

Chiton (*Acanthropleura*) *mucronulatus* Shuttleworth, Berner Mitth., p. 79, 1853.

Eastern Porto Rico (Gundlach).

Genus CERATOZONA Dall, 1882.

Shell with strong, exposed valves. Insertion plates of anterior valve long, sharp, rough outside, thickened at the slits, which correspond in position to the external ribs; middle valves with similar propped teeth. Girdle tough, bearing peculiar hornlike spines, generally sparsely bunched at the sutures.

Ceratozona rugosa Sowerby.

Chiton rugosus (Gray) Sowerby, Conch. Ill., No. 6, fig. 49, 1841?

Shell oblong, rather convex; surface generally eroded; green, olive, or blackish, the central areas whitish along the middle, flamed with blackish or green at the sides; tail valve with a broad, pink ray behind; lateral areas defined by a strong rounded rib, having a sculpture of irregular, wavy wrinkles over ribs and interval and on the sides of the center.

Length, 40; breadth, 25 mm.

Aguadilla, Porto Rico, two specimens.

Genus ACANTHOCHITES Risso, 1826.

Valves partly buried in the girdle, the exposed part consisting of a smooth or striated dorsal band and granulated side areas, the latter sometimes lacking; anterior valve with five symmetrically placed slits; median valves with one slit on each side; posterior valve with two to several slits; girdle hairy to naked, but always having four bristle-bearing pores around the head valve and a series of pores on each side at the sutures.

Acanthochites spiculosus Reeve.

Chiton spiculosus Reeve, Conch. Icon., pl. IX, fig. 47, 1847.

Shell elongate-ovate; valves semilunar, rough throughout; blackish brown; ligament horny, furnished with thick tufts of bright greenish glassy spiculæ.

Acanthochites spiculosus var. **astriger** Reeve.

Chiton astriger Reeve, Conch. Icon., *Chiton*, pl. XVIII, fig. 109, 1847.

Shell oblong, rather depressed, not carinated; valves variously colored, often with rather wide white stripes on the sides; girdle velvety, olive green, with eighteen large tufts of greenish spicules, the periphery having a fringe of spicules.

Length, 20; breadth, 9 mm.

Fajardo, Porto Rico; Ensenada Honda, Culebra. Only one variety was collected.

Acanthochites hemphilli Pilsbry.

Acanthochites hemphilli Pilsbry, Man., XIV, p. 34, pl. XIII, figs. 65–67, 1892.

Animal elongated; the shell narrow, not exceeding one-fourth the total width in alcoholic specimens, scarcely carinated, somewhat ovate, truncated behind, brownish red marked with white; girdle pale brown, roughened with minute scales or spicules, with a fringe of longer white spicules at its edge and containing eighteen small tufts of red-brown or whitish spicules.

Length, 35; breadth, 17 mm. Other specimens are smaller.

Ensenada Honda, Culebra.

Class SCAPHOPODA.

Order SOLENOCONCHA.

Family DENTALIDÆ.

Genus DENTALIUM Linnæus, 1758.

Shell tubelike, curved, but not spiral, attenuated posteriorly; anterior orifice larger than that at the posterior end; dorsal face concave; ventral face convex; no operculum.

Subgenus DENTALIUM s. s.

Dentalium gouldi Dall.

Dentalium gouldi Dall, Blake Report, II, p. 424, pl. XXVI, fig. 4, 1889.

Shell elongated, slender, slightly or considerably curved; surface polished, sometimes having longitudinal microscopic striæ, hexagonal throughout most of its length but often round at the aperture, the angles pinched up into distinct ribs. Color vitreous or milky white.

Length, 42; diameter, 2.5 mm.

Mayaguez Harbor, Porto Rico, one fine specimen and two small ones.

This has been more or less generally known under the name of *D. hexagonum* Gould, but it is not the original *D. hexagonum*, which comes from China.

Subgenus ANTALIS H. & A. Adams, 1854.

Dentalium taphrium Dall. Plate 54, fig. 19.

Dentalium taphrium Dall, Bull. Mus. Comp. Zool., XVIII, p. 422, 1889.
Dentalium taphrium Pilsby & Sharp, Man., XVII, p. 58, 1897.

Shell small, rather stout, moderately curved, with thirty or more low ribs, those of the dorsal face stronger; posteriorly every alternate rib becomes weaker and finally disappears; incremental lines close, fine, and sharp. Color pale apple-green. Both orifices are circular.

Length, 17; diameter, 2.25 mm.

Mayaguez, Porto Rico, two half-grown dead shells.

Dentalium disparile d'Orbigny.

Dentalium disparile d'Orbigny, Moll. Cubana, II, p. 202, pl. XXV, figs. 14-17, 1845.

Shell small, solid, somewhat curved, opaque white, the ribs often blotched with gray, with nine or ten primary ribs, often with intermediate ribs at the smaller end; aperture circular, showing the riblets on its border; anal orifice small, entire.

Length, 20; diameter, 2 mm.

A fragment of the posterior end of a shell was obtained at Mayaguez, Porto Rico.

Dentalium ceratum Dall.

Dentalium ceratum Dall, Bull. Mus. Comp. Zool., IX, p. 38, 1881.
Dentalium ceratum Dall, Blake Report, II, p. 424, pl. XXVI, fig. 5, 1889.

Shell moderately curved, the anterior part smooth and shining, milky white; posterior part dull greenish; there are from seven to ten well-developed ribs at the posterior end, and there are intermediate riblets farther up the shell; all the ribs fade out on the upper third; apertures simple.

Length, 30; diameter, 5 mm.

Two fine shells were obtained at Mayaguez Harbor, Porto Rico.

Dentalium antillarum d'Orbigny.

Dentalium antillarum d'Orbigny, Moll. Cubana, II, p. 202, pl. XXV, figs. 10-13, 1845.

Shell small, solid, and stout; last third more strongly curved than the remainder; white or greenish yellow; ribs numerous, subequal or alternately larger and smaller, low, rounded; aperture circular. The ribs are often marked with gray.

Length, 23; diameter, 2.5 mm.

Mayaguez, Porto Rico, two dead shells.

Subgenus LÆVIDENTALIUM Cossmann, 1888.

Dentalium callipeplum Dall.

Dentalium callipeplum Dall, Blake Report, II, p. 419, pl. XXVII, fig. 12*b*, 1889.

Shell ivory white or flesh color, polished, evenly curved, rapidly increasing; sculpture of faint, scattered, incremental lines; apertures round; in the adult that of the posterior end has a wide, shallow notch on the concave side.

Length, 61; diameter, 5 mm.

Mayaguez, Porto Rico, two young, worn shells and one beautiful specimen two-thirds grown.

Dentalium matara Dall.

Dentalium matara Dall, Blake Report, II, p. 420, 1889.
Dentalium matara Pilsbry & Sharp, Man., XVII, 8, p. 105, pl. XVIII, figs. 14-18, 1897.

Shell slender, moderately and evenly curved, polished, salmon or flesh colored, becoming lighter anteriorly, with very faint lines of growth; aperture circular; anal opening notched on the concave and convex sides, the latter notch is carried up the tube as a slit.

Length, 40; diameter, 2.75 mm.

San Juan; Mayaguez, Porto Rico, a few specimens in an immature state.

Subgenus EPISIPHON Pilsbry & Sharp, 1897.

Dentalium filum Sowerby.

Dentalium filum Sowerby, Thes. Conch., III, p. 89, pl. CCXXV, fig. 45, 1860.

Shell delicate, slender, white, moderately curved, nearly transparent, glossy, sculptured with very fine microscopic concentric lines which are seen most plainly at the posterior end; aperture circular, the margin more or less irregular; posterior end truncated, with an internal pipe, slightly notched.

Length, 12.5; diameter, 1.25 mm.

Mayaguez, Porto Rico, two worn shells.

Subgenus FUSTIARIA Stoliczka, 1868.

Dentalium stenoschizum Pilsbry & Sharp.

Dentaliun stenoschizum Pilsbry & Sharp, Man., XVII, p. 128, pl. XIX, figs. 18–21, 1897.

Shell considerably curved especially toward the smaller end, the earlier part slender, rapidly increasing in the maturer part; smooth and polished throughout, aperture somewhat oblique, compressed a trifle laterally, peristome thin; anal opening circular, having a very long, narrow slit on the convex side of the shell and nearly one-third of its length. Color milk white, tinted a little with brownish on the earlier growth.

Length, 35; greatest diameter, 3.4 mm.

Mayaguez, Porto Rico, one fine, half-grown shell.

Genus CADULUS Philippi, 1844.

Shell small, tubular or oval in section, somewhat arcuate, more or less swollen at or above the middle, contracting toward the aperture; surface smooth or delicately striate.

Section POLYSCHIDES Pilsbry & Sharp, 1897.

Cadulus carolinensis var. **bushii** Dall.

Cadulus (*carolinensis* var.?) *bushii* Dall, Blake Report, II, p. 430, 1889.
Cadulus carolinensis var. *bushii* Pilsbry & Sharp, Man., XVII, p. 153, pl. XXXIII, figs. 58, 59, 1897.

Shell of medium size, semitransparent, glossy, bluish white, nearly circular throughout; greatest diameter about at the anterior third, abruptly constricted behind the swollen part, well curved; aperture oblique, subcircular, inflexed along the convex margin.

Length, 6.5; diameter, 1.25 mm.

Mayaguez, Porto Rico, a large number of specimens.

Section GADILA Gray, 1847.

Cadulus minusculus Dall.

Cadulus minusculus Dall, Blake Report, II, p. 432, 1889.
Cadulus minusculus Pilsbry & Sharp, Man., XVII, p. 164, pl. XXXII, figs. 42, 43, 1898.

Shell minute, curved, moderately swollen near the middle, regularly curved on the convex side, but slightly curved on the concave side, both ends small; surface smooth, glossy whitish; aperture circular.

Length, 2.3; diameter, a little more than 0.5 mm.

Mayaguez, Porto Rico, one shell.

Cadulus amiantus Dall.

Cadulus amiantus Dall, Blake Report, II, p. 431, pl. XXVII, fig. 7, 1889.

Shell rather elongated, moderately curved, the very gradual swelling about one-fourth of the way back from the anterior end; mouth not oblique, with the posterior opening circular. Color milky white, somewhat translucent.

Length, 5.75; diameter, 1.5 mm.

Mayaguez, Porto Rico, a large number of shells.

Cadulus acus Dall.

Cadulus acus Dall, Blake Report, II, p. 432, pl. XXVII, fig. 11, 1889.

Shell small, slender, curved, milky white, variegated with translucent patches and markings on the anterior half which is smooth and shining; posterior half or third of the shell sculptured with very fine, annular grooves; greatest diameter immediately behind the aperture, from which there is a gradual diminution in size to the posterior end; the slope from the swelling to the anterior end is rapid.

Length, 8; diameter of aperture, 0.5; greatest diameter, 0.75 mm.

Mayaguez, Porto Rico, three specimens.

Besides the above, a number of broken specimens of *Cadulus* were obtained at Mayaguez which are not in a condition to be identified.

Class PELECYPODA.

Order PRIONODESMACEA.

Superfamily NUCULACEA.

Family NUCULIDÆ.

Genus NUCULA Lamarck, 1799.

Shell equivalve, closed, triangular, inequilateral, the posterior end short; beaks generally inclined to the rear; surface smooth or ornamentally sculptured; hinge with an internal, triangular fossette, containing a resilium and having on each side a row of sharp teeth; internal shell layer nacreous.

Nucula ægeënsis Jeffreys.

Nucula ægeënsis Jeffreys, P. Z. S., 1879, p. 581; Dall, Blake Report, I, p. 246, 1886.

Shell rather small, thin, nearly regularly ovate, scarcely oblique, uniformly convex, and having a low, rounded posterior ridge; beaks projecting but little beyond the rest of the shell, straight; sculpture of exceedingly fine concentric ridges; hinge line rather broad; teeth few; cartilage pit small.

Length, 10.7; height, 8; diameter, 4.7 mm.

Mayaguez, Porto Rico, one young left valve. The species is close to *N. tenuis* Montagu.

Family LEDIDÆ.

Genus LEDA Schumacher, 1817.

Shell solid, oval-oblong, more or less beaked behind; beaks somewhat turned backward; surface concentrically and obliquely furrowed, with a posterior ridge or carina; hinge teeth numerous, similar fossette containing the resilium internal, placed below the beaks; pallial line feebly sinuous; internal layer porcellanous.

Leda acuta Conrad.

Nucula acuta Conrad, Am. Marine Conch., p. 32, pl. VI, fig. 3, 1831.

Shell inflated, irregularly long oval; anterior end rounded, but somewhat drawn out, with a ridge running from the beaks to the anterior base; posterior ridge strong, curved downward in the middle, the dorsal slope truncated and partly sunken so as to form a sort of escutcheon; beaks full, about two-fifths of the length of the shell from anterior end; sculpture consisting of fine, well-defined ridges, which are more or less concentric, but often oblique at the ends; hinge strong and wide, divided about midway by the fossette, with strong V-shaped teeth; interior of the shell shining. Color greenish olive.

Length, 9; height, 5; diameter, 3.5 mm.

Mayaguez Harbor, Porto Rico, a great number of specimens.

The character of the sculpture is variable. In some specimens there are traces of cancellation in front.

Genus NEILONELLA Dall, 1881.

Shell inflated, the ends drawn out but rounded, with a single ligament directly between the beaks, chiefly external, but its base dividing the hinge line while the upper surface extends about equally before and behind the beaks; teeth strong.

Neilonella corpulenta Dall.

Leda (*Neilonella*) *corpulenta* Dall, Bull. Mus, Zool., IX, 1881, p. 125; Blake Report, I, p. 254, pl. VII, figs. 1*a*, 1*b*, 1886.

Shell irregularly elliptical, inflated, solid, with rather high, full beaks; the posterior ridge low and close to the hinge; surface covered with well-defined, concentric ridges; hinge moderately strong, the posterior part a little longer than the anterior; teeth sharp, elongated, much reduced in size under the beaks; interior of the shell smooth and shining.

Length, 10, height, 6.5; diameter, 4.5 mm.

Mayaguez, Porto Rico, two opposite worn valves.

Superfamily ARCACEA.

Family ARCIDÆ.

Subfamily PECTUNCULINÆ.

Genus GLYCYMERIS Da Costa, 1778.

Shell suborbicular, solid, equivalve, subequilateral, convex, with a velvety epidermis; area moderate; within porcellanous; hinge wide, flat, curved, bearing divergent, taxodont teeth, which are faint under the beaks; muscular impressions subequal; pallial line simple.

Glycymeris pennaceus Lamarck.

Pectunculus pennaceus Lamarck, An. sans Vert., VI, p. 51, 1819.
Pectunculus pennaceus Reeve, Conch. Icon., pl. V, fig. 24, 1843.

Shell solid, suborbicular, somewhat inflated, with rather full, high beaks which are placed slightly in front of the center; ligamental area rather narrow; ligament strong; surface with very low, wide, radiating ribs, which, with the spaces between them, are covered with delicate, radiating liræ; growth lines fine and varied, forming a peculiarly reticulated or latticed pattern of sculpture; hinge line less curved than remaining border of shell; teeth not numerous, faint, or wanting under the beaks interior faintly radially striate within the pallial line. The surface is covered with a delicate, velvety epidermis, which is often wanting at the umbonal region and soon becomes worn off after the death of the animal. Color whitish, with irregular, subradial markings and cloudings of chestnut.

Length, 60; height, 55; diameter, 35 mm.

San Juan Harbor; Boqueron Bay, Porto Rico; Culebra; Vieques.

This species, which is not at all common, was obtained abundantly living and in very fine condition at Vieques. Some of these specimens considerably exceed the measurements given.

Glycymeris pectinatus Gmelin.

Arca pectinata Gmelin, Syst. Nat., p. 1313, 1792.
Pectunculus charlestonensis Holmes, P. Pl. Foss. S. Car., p. 16, pl. III, fig. 5, 1860.

Shell somewhat fan-shaped, solid, scarcely inflated, with high beaks and a narrow area, subequilateral, with about twenty-four rounded, often slightly curved ribs, which are crossed by fine, concentric striæ; teeth fainter and sometimes wanting under the beaks; margin of shell decidedly toothed. Color whitish, variously blotched with chestnut, the blotches sometimes zigzagged and subconcentric.

Length, 20; height, 20; diameter, 10 mm.

Mayaguez, Porto Rico, a few dead valves.

Subfamily ARCINÆ.

Genus ARCA Linnæus, 1758.

Shell generally equivalve, thick, subrhomboid, inflated, ribbed or cancellate, covered with a thick epidermis; valves closed below, or open for the passage of a byssus; hinge straight, with a nearly or quite continuous row of numerous, almost straight, subradiating teeth; beaks prominent, incurved, separated by a lozenge-shaped area, with numerous cartilages embedded in grooves.

Subgenus ARCA s. s.

Arca occidentalis Philippi.

Arca occidentalis Philippi, Abbild. und Beschr., III, p. 14, pl. XVII, B, figs. 4 *a–c*, 1847.

Shell oblong, wider and truncated behind, solid, inflated, with a moderate posterior ridge, the basal and posterior parts covered with a shaggy epidermis; in front of the middle of the base there is a long, narrow gap through which the byssus passes; surface decidedly ribbed; in the middle of the shell there are large ribs with three or four smaller ones between; hinge long and straight, with a lozenge-shaped central area covered with dark ligament, with resiliary threads embedded in grooves;

hinge teeth very numerous and even; inside the surface is slightly grooved within the pallial line. Color pale brownish, often purple tinted, with wide, wavy, or zigzag, zebra-like stripes of brown.

Length, 90; height, 40; diameter, 50 mm.

Mayaguez, many specimens; off Point Melones; Arroyo, Porto Rico.

Arca umbonata Lamarck.

Arca umbonata Lamarck, An. sans Vert., VI, p. 37, 1819.
Arca umbonata Philippi, Abbild., III, p. 13, pl. XVII, B, fig. 3 *a–c*, 1847.

Shell rhomboid, solid, inflated, with a high, sharp posterior ridge and obliquely truncated behind; surface in front of the posterior ridge sculptured with rather fine, radiating ribs which are crossed by irregular, concentric ridges and rendered subcancellate; behind the posterior ridge are about eight stronger, subnodulous ridges; base of shell gaping in front of middle; beaks separated by a rather wide, lozenge-shaped area; epidermis blackish, shaggy, standing out in long, striate, leaf-like projections on posterior ridge; beak cavities deep. Color purplish brown within and without.

Length, 50; height, 20; diameter, 20 mm.

Puerto Real; Boca Prieta; San Juan; Guanica; Mayaguez, Porto Rico.

Subgenus BARBATIA (Gray) Adams, 1858.

Arca barbata Linnæus.

Arca barbata Linnæus, Syst. Nat., ed. x, p. 693, 1758.
Arca barbata Reeve, Conch. Icon., IV, pl. XIII, fig. 83, 1844.

Shell subsolid, oblong, or long-rhomboid, generally rounded at each end, moderately inflated, slightly gaping below; beaks rather high, situated one-fourth of the way back from the anterior end and separated by a rather narrow ligamental area; surface closely sculptured by various-sized radiating ribs, which are crossed by concentric ridges making it cancellated or reticulated, the nodules on the ribs often bead-like; posterior ridge low and rounded; epidermis shaggy at the base and posterior end; hinge teeth rather few, not strongly developed. Color chestnut, often with lighter clouds, sometimes with white rays at the beaks and occasionally one or more of these rays extends to the edge of the shell.

Length, 50; height, 28; diameter, 17 mm.

San Geronimo; Guanica; Fajardo, Porto Rico; Ensenada Honda, Culebra; Caballo Blanco Reef, Vieques.

Arca candida Gmelin.

Arca candida helblingi Chemnitz, VII, p. 195, pl. LV, fig. 542.
Arca candida Gmelin, Syst. Nat., p. 3311, 1792.

Shell thin to solid, rather compressed, subtrapezoidal, gaping at the anterior base; anterior end generally truncate; posterior end pointed and obliquely truncate above; beaks high, separated by a moderately wide area; surface sculptured with fine to rather strong double or single, large or small ribs which are heavier on the posterior slope. These are crossed by rude, irregular growth lines and ridges, causing the surface to appear somewhat cancellated and beaded; epidermis heavy, shaggy; teeth feebly developed. Color white.

Length, 60; height, 35; diameter, 28 mm.

Puerto Real; reefs at Ponce; Mayaguez; San Juan Harbor, Porto Rico.

Arca reticulata Gmelin.

Arca reticulata, etc., Chemnitz, Conch. Cab., VII, p. 193, pl. LIV, fig. 540.
Arca reticulata Gmelin, Syst. Nat., p. 3311, 1792.

Shell small, solid, inflated, subrhomboid, with a well-defined posterior ridge which ends in a point at the posterior base; anterior end rounded; beaks full, placed well forward, the area between them narrow; sculpture consisting of rather strong, radiating ridges which cross still stronger concentric ones, the ridges sometimes scaly, and this is especially the case on the somewhat truncated posterior end; hinge rather short; the teeth moderately developed; border of shell denticulate. Color whitish.

Length, 20; height, 11; diameter, 9 mm.

Reefs at Ponce; Mayaguez; Guanica; San Juan Harbor; Hucares, Porto Rico; Caballo Blanco Reef, Vieques.

Arca adamsi (Shuttleworth) Smith.

Arca (*Acar*) *adamsi* (Shuttleworth) Smith, Journ. Lin. Soc., Zool., xx, p. 499, pl. xxx, figs. 6, 6*a*, 1888.

Shell moderately solid, rhomboid, inflated, rounded in front, the hinge and base line parallel, the posterior end obliquely subtruncated; posterior ridge high but rounded; beaks only moderately full, turned forward, separated by a narrow area; surface having numerous pseudo-ribs consisting of more or less connected blisters, with strong, concentric sculpture; teeth few, rather strong.

Color whitish or brownish. There is a curved ridge below and inside of the muscular impressions.

Length, 12; height, 7.5; diameter, 7.5 mm.

Aguadilla; Ponce; Mayaguez; San Juan Harbor, Porto Rico; Vieques.

Subgenus Scapharca (Gray, 1847) Dall.

Arca campechensis Gmelin.

Arca campechensis Gmelin, Syst. Nat., p. 3312, 1792.
Arca americana Reeve, Conch. Icon., ii, *Arca*, fig. 21, 1844.

Aguadilla; San Juan, Porto Rico (Gundlach).

Arca deshayesii Hanley.

Arca deshayesii Hanley, Ill. Cat. Biv. Shells, p. 157, 1842.
Arca deshayesii Reeve, Conch. Icon., ii, pl. vii, fig. 47, 1844.

Shell oblong, inflated, solid, subrhomboid, with high, full beaks which are separated by a rather narrow area, angled at the hinge line in front, with about twenty-seven strong, rounded ribs which are crossed by concentric threads; hinge teeth rather numerous, well developed. Color whitish, covered with a silky, brown epidermis.

Length, 65; height, 45; diameter, 45 mm.

Mayaguez; San Juan, Porto Rico; Vieques.

Arca secticostata Reeve.

Arca secticostata Reeve, Conch. Icon., *Arca*, fig. 38, 1844.

Shell irregularly rhomboid, somewhat elongated, with high, rather full beaks, situated at one-fourth of the distance from the anterior to the posterior end, solid, inflated, with a moderately wide area; posterior ridge not elevated, somewhat rounded; anterior end angular at the hinge; posterior end obliquely truncate below the hinge; surface sculptured with about thirty-five ribs, those of the middle and anterior end grooved; posterior ribs rounded; all except those on the posterior slope are more or less beaded; hinge long; the teeth numerous and well defined, but not high; the border within the shell is strongly denticulate. Color white; epidermis brownish, shaggy.

Length, 85; height, 52; diameter, 52 mm.

Mayaguez, Porto Rico, several young and worn valves.

Arca chemnitzi Philippi.

Arca chemnitzi Philippi, Zeitschr. für Mal., viii, p. 50, 1851.
Arca d'orbignyi Kobelt, Mart. Chemn. Conch. Cab., 2te Ausg., p. 57, No. 41, pl. xvi, figs. 7, 8, 1891.

Shell irregularly triangular, slightly inequivalve, solid, with very high incurved beaks, with a lozenge-shaped area; anterior end angular at the hinge, but the angle projects but little beyond the general outline; posterior ridge high, somewhat rounded; surface sculptured with about twenty-five nodulous ribs, which are often flattened; epidermis softly spinose in the grooves of the anterior half of the shell, thick and lamellar on the posterior part; hinge short, teeth distinct; beak cavities deep; inner edge of the shell strongly dentate. Color white.

Length, 30; height, 30; diameter, 30 mm.

Playa de Ponce; Mayaguez Harbor; off San Juan; Catano; Boqueron Bay, Porto Rico; Culebra Island; Vieques.

Some of these specimens are much larger than any of this species which have hitherto been reported.

Superfamily PTERIACEA

Family PINNIDÆ.

Genus PINNA (Linnæus) Lamarck, 1799.

Shell thin, attached by a byssus, elongate, triangular, not auriculate, with pointed terminal beaks; posterior part truncated, gaping; ligament linear, elongated, lodged in a furrow. The middle of the shell is longitudinally sulcate and the inner nacreous layer is deeply bilobed at this sulcation.

Pinna carnea Gmelin.

Pinna carnea Gmelin, Syst. Nat., p. 3365, 1792.
Pinna flabellum Reeve, Conch. Icon., pl. x, fig. 18, 1858

Mayaguez, Porto Rico (Gundlach).

Genus ATRINA Gray, 1840.

Shell attached, elongate, triangular, thin, with pointed terminal beaks, truncated or rounded posteriorly, generally more or less covered with scales; valves unsulcate or without a median carina, and the internal nacreous layer is entire.

Atrina rigida Dillwyn.

Pinna rigida (Solander MSS.) Dillwyn, Cat., I, p. 327, 1817.
Pinna subviridis Reeve, Conch. Icon., *Pinna*, pl. XVII, fig. 32, 1858.

Shell somewhat elongately triangular, thin or somewhat thickened, slightly inflated; hinge line straight or incurved; ventral margin rounded at the middle; posterior end truncate or subtruncate, gaping; all of the shell except the ventral region is covered with low radiating ribs, which may be smooth or covered with more or less elevated scales; the scales sometimes become elongated and almost tubular; ventral area smoother, without ribs, often having prickly scales; inner layer smoky brown, faintly iridescent. Color blackish, olive brown, or ashy.

Length, 25; height, 13; diameter, 4 cm. Mayaguez Harbor, Porto Rico, two fragments and a young shell.

Family MELINIDÆ.

Genus MELINA Retzius, 1788.

Shell attached, subequivalve, inequilateral, compressed, with a posterior wing, somewhat subrhomboid or subquadrate; ligament multiple, lodged in a series of vertical, parallel pits along the hinge line; muscular impression subcentral; right valve with a byssal sinus below the hinge.

Melina alata Gmelin.

Ostrea alata Gmelin, Syst. Nat., p. 3339, 1792; Chemnitz, Conch. Cab., VII, pl. 59, fig. 581.
Perna ephippium Reeve, Conch. Icon., XI, pl. II, fig. 8, 1858.

Shell subquadrate or subtrapezoidal, greatly compressed, moderately solid; right valve nearly flat; left valve slightly convex; posterior wing low; hinge line short, with from seven to fifteen pits in each valve; left valve much thickened in front below the hinge; the right with a small byssal sinus opposite the swelling; exterior either nearly smooth or somewhat scaly; inner pearly layer of the shell not reaching the shell border. Color brownish, purple, or blackish, often marked with lighter color and white on the earlier part of the shell, which, when young, is sometimes rayed.

Length, 80; height, 80; diameter, 8 mm.

Puerto Real; Mayaguez, Porto Rico; Ensenada Honda, Culebra. At the former locality great numbers of fine specimens were found attached to the roots of mangroves and to each other.

Melina listeri Hanley.

Perna listeri Hanley, Ill. Cat. Rec. Biv. Shells, p. 259, 1846; Lister, pl. 228, fig. 63.

Shell irregular, subquadrate, greatly drawn out and developed at the base; hinge line with from three to seven pits in each valve; posterior wing small; sinus of the right valve wide and rounded; left valve fuller than the right. The base of the shell is developed into a long, irregular, tongue-like process of porcellanous matter; the nacreous part does not extend more than half way from the hinge to the base. Color ashy, brownish, or purple brown, irregularly rayed with lighter color.

Length, 25; height, 60; diameter, 7 mm.

Puerto Real; Mayaguez; Ponce; Guanica; Hucares; Arroyo, Porto Rico; Ensenada Honda, Culebra.

Melina semiaurita Linnæus.

Ostrea semiaurita Linnæus, Mus. Lud. Ulric., p. 535, 1764.
Perna bicolor C. B. Adams, Proc. Bost. Soc. Nat. Hist., v, 1845, p. 9.
Concha semiaurita Chemnitz, Conch. Cab., VII, p. 250, pl. 59, fig. 580, 1784 (nonbinomial).

Shell small, subquadrate, solid, somewhat inflated, very irregular, hinge line having three or four large pits in each valve; byssal notch small. The surface is covered with strong, irregular, scaly ridges; the base in adult shells often projects somewhat tongue-like, and to some distance below the nacreous layer. Color ashy to blackish.

Length, 12; height, 16; diameter, 8 mm.

San Juan, two specimens.

This species grows in the crevices of corals and rocks and is as variable in form as any oyster. It may prove to be only a littoral form of the preceding species. It is the *Perna chemnitziana* of d'Orbigny, 1846.

Family PTERIIDÆ.

Genus PTERIA Scopoli, 1777.

Shell suborbicular or oblique, thin or solid, slightly inequivalve, the left valve being more convex than the right; right valve with a distinct byssal notch and sinus near its upper anterior part; valves winged before and behind; hinge with rudimentary pseudocardinals and laterals; ligament elastic, placed in an oblique fossette; inner shell layer brilliantly nacreous, not extending to the shell border.

Pteria radiata Leach.

Avicula radiata Leach, Zool. Miscellany, I, p. 98, pl. XLIII, 1814.

Shell suborbicular or subquadrate, rather thin, somewhat inflated, more or less oblique, the hinge about as long as the body of the shell, moderately winged before and behind; surface, especially toward the edges of the shell, having radiating rows of strong, somewhat elongated scales, more or less variegated with purple, brown, and whitish, sometimes feebly rayed; pseudocardinals faint, single in each valve; laterals single in the left valve and double in the right; nacre brilliant, surrounded by a wide, prismatic border.

Length, 40; height, 38; diameter, 16 mm. Length of another, 50; height, 50; diameter, 18 mm.

Off Boca Prieta; Mayaguez Harbor, Porto Rico.

Sometimes the surface is almost smooth.

Superfamily OSTRACEA.

Family OSTREIDÆ.

Genus OSTREA Linnæus, 1758.

Shell irregular, fixed by the left or lower valve which is excavated; right valve generally plane or concave, always less convex than the left, often plaited or foliaceous, and having a prominent beak; ligamental area triangular or elongated; structure subnacreous; hinge edentulous; adductor impression single.

Ostrea virginica Gmelin.

Ostrea virginica Gmelin, Syst. Nat., p. 3336, 1792.
Ostrea rostrata Sowerby, Conch. Icon., XVIII, pl. VI, 1871.

Shell elongated, irregular, elliptical oval, or nearly circular, straight or curved; left valve usually excavated; right valve generally flat, sometimes concave or a little convex; lower valve with a strong, usually elongated beak, its hinge having a wide channel in center and marked with lines exhibiting the successive removes of the cartilage; upper valve with a shorter beak, with a faint ridge in the hinge area opposite channel of left valve; muscular impression near center strong and large, often dark.

Mayaguez; Puerto Real, Porto Rico; Ensenada Honda, Culebra.

It is almost impossible to give a description that will cover all the forms of this protean species, which varies infinitely with the locality and environment in which it grows. Specimens in northern waters attain a length of a foot, and where they are crowded in the beds are long and tongue-like. Those living on flat stones and timber are often nearly circular. The Porto Rican specimens for the most part are attached to the swinging aërial roots of the mangroves.

Ostrea cristata Born.

Ostrea cristata Born, Mus. Vind., p. 112, pl. VII, fig. 3, 1780.

Shell moderately solid, exceedingly irregular, elongated, rounded or oval; upper valve sometimes concave, at other times convex; lower valve convex; valves often furnished with elongated, tubular, or solid, clasping processes, by means of which the shell is attached to mangrove roots or other objects; edges of the valves strongly and sharply plicate-serrate, forming closely interlocking teeth; within, the border is often pustulose ridged, or striate; beaks very irregular, that of the lower valve the longer, its hinge area centrally grooved; muscular scars not deep. Color reddish, purplish, or brownish.

Specimens attain a diameter of 90 mm.

Gallardo Bank, Porto Rico.

This species is even more irregular and variable in its growth than *O. virginica*.

Ostrea frons Linnæus.

Mytilus frons Linnæus, Syst. Nat., ed. x, p. 704, 1758.
Ostrea frons Sowerby, Conch. Icon., XVIII, pl. XIX, fig. 41, 1871.

San Juan, Porto Rico (Gundlach). The *Ostrea parasitica* Gmelin, credited to Porto Rico by Gundlach, is probably a form of *O. cristata* Born.

Family PECTINIDÆ.

Genus PECTEN Müller, 1776.

Shell suborbicular, inequivalve, not gaping nor attached, sculpture usually radial; auriculate; right valve convex, with a notch below the anterior ear, generally inflated at the beak; left valve concave, flat or slightly convex; hinge margins straight, united by a narrow ligament: resilium internal, in a central pit; adductor impression duplex.

Subgenus PECTEN s. s.

Section EUVOLA Dall.

Pecten laurentii Gmelin.

Ostrea laurentii Gmelin, Syst. Nat., p. 3317, 1792.
Pecten laurenti Reeve, Conch. Icon., VIII, pl. XVI, fig. 58, 1853.

Shell nearly orbicular, equilateral, rather thin, decidedly inequivalve, smooth and shining; left valve nearly flat in an anterior and posterior direction, but inflated in a direction from the beaks to the base, having a decided radial shoulder above on each side under the ears. It has very faint, low, wide, radiating ridges, and in addition minute radial threads, which are crossed by feeble concentric growth lines, ridged within with numerous radiating bars; right valve evenly convex, externally sculptured like left valve, with fine, radial ribs within arranged in pairs; ears nearly equal. The left valve is dark purplish red, with faint, radiating, lighter-colored rays; toward its upper part it is beautifully mottled with yellowish or pinkish white, and occasionally marked with oblique, light-colored strigations. There are also a few dark reddish-brown spots on the upper part of the shell. The right valve is whitish or buff, feebly rayed with brownish.

Height, 90; length, 90 mm.

A number of adult living specimens of this very fine and rare species were dredged in 7 fathoms in the harbor of Mayaguez.

Pecten ziczac Linnæus.

Ostrea ziczac Linnæus, Syst. Nat., ed. x, p. 696, 1758.
Pecten ziczac Reeve, Conch. Icon., VIII, pl. VI, fig. 29, 1852.

Shell rather solid, nearly orbicular, equilateral; left valve slightly concave, with a low but decided radiating shoulder on each side below the ears, with wide, low, distinct radiating ribs, crossed by faintly squamose growth lines, radiately ridged within around the border; right valve deeply convex, with widely spaced radiating grooves, the radiating ridges within inclined to be somewhat double; ears nearly equal, slightly radially ribbed. Both valves with faint crura at the bases of the ears. Left valve painted with red-brown, buff, lilac and white, in broken, radiating patterns, brown bordered within; right valve reddish brown, becoming dusky at the border, marbled with white near the beaks.

Length, 100; height, 90; diameter, 26 mm.

Mayaguez Harbor, Porto Rico, one young specimen.

Pecten medius Lamarck.

Pecten medius Lamarck, An. sans Vert., VI, 1819, p. 163: Chemnitz, Conch. Cab., VII, pl. LX, figs. 586, 587, 589, 1784.

Shell nearly orbicular, rather solid; left valve decidedly concave, with strong, radial shoulders, sculptured with well developed, rounded ribs and delicate, somewhat lamellar growth lines, which are fainter on the ribs, deeply, radially grooved within at the border; right valve strongly convex, with wide, rounded or flattened ribs, which are sometimes broken up into smaller ridges; interior ribs of right valve somewhat double; both valves with faint crura at the base of the ears; ears nearly even, ridged. Left valve red or purplish sometimes variegated with small, lighter blotches, generally having a lighter, well-marked area at the beak; right valve purplish or whitish, sometimes faintly marbled.

Length, 50; height, 47; diameter, 13 mm.

Mayaguez Harbor, Porto Rico, two young opposite valves; off St. Thomas, one specimen.

Subgenus CHLAMYS Bolten, 1798.

Section PLAGIOCTENIUM Dall, 1898.

Pecten mayaguezensis, n. sp. Plate 55, figs. 7, 8, 9.

Shell small, solid, slightly inequilateral, inequivalve; the left or upper valve less convex, polished, white, with beautiful zigzag, subconcentric, linear, or flecked painting of dark red; ribs eighteen or nineteen, angular at the summit, with subequal, not channeled interspaces, the whole without sculpture except microscopic incremental and obsolete fine radial lines; ears practically smooth, the posterior longer; lower valve more convex, white except near the umbo, where there are a few brown flecks; sculpture about the same, except that the summits of the ribs are more rounded; anterior ear with two or three radial threads, a shallow sulcus and short ctenolium; submargins smooth; interior channeled near margin with well-marked auricular crura; hinge in right valve strong, with a long, horizontal ridge on each side of the resiliary pit corresponding to a similarly placed sulcus in the opposite valve; above the last-mentioned sulci in left valve is a similar pair of ridges; hinge showing strong provincular cross striation; cavity of left valve reddish, of right valve white or yellowish.

. Length of shell, 21; height, 19; diameter, 8.5 mm. Living in 7 to 15 fathoms, sand and mud, Mayaguez Harbor, Porto Rico, at stations 6058 and 6061.

This is an extremely elegant little shell, perfectly distinct from any recorded species.

Pecten gibbus Linnæus.

Ostrea gibba Linnæus, Syst. Nat., ed. X, p. 698, 1758.
Pecten gibbus Reeve, Conch. Icon., VIII, pl. IX, fig. 37*a*, 1852.

Aguadilla, Arecibo; San Juan, Porto Rico (Gundlach).

Section NODIPECTEN Dall, 1898.

Pecten nodosus Linnæus.

Ostrea nodosa Linnæus, Syst. Nat., ed. X, p. 697, 1758.
Pecten nodosus Reeve, Conch. Icon., VIII, pl. III, fig. 15, 1852.

Shell suborbicular, nearly equivalve, sculptured with eight or nine strong, rounded, nodose ribs, which are separated by rounded grooves of nearly equal width with the ribs; the entire surface is also covered with fine, distinct, riblets and concentric lamellar growth lines, which are faint on the ribs; nodules very strong, usually faint or wanting on the upper part of the shell; interior of the valves ribbed but otherwise smooth; ears unequal, strongly ridged, the posterior pair smaller; anterior ear of right valve deeply notched at its base. Color dark purplish, red, or scarlet, the young shell sometimes irregularly concentrically banded with white.

Length, 75; height, 80 mm. St. Thomas, one young valve.

Sometimes the nodules become blistered and the outer shell is broken at the blisters.

Section CHLAMYS s. s.

Pecten ornatus Lamarck.

Pecten ornatus Lamarck, An. sans Vert., VI, p. 176, 1819 (Enc. Method., pl. CCXIV, fig. 5).

Shell rather thin, high, inequilateral, nearly equivalve, with elevated, smooth, or scaly ribs, which are separated by deep, excavated channels; sometimes the ribs are compound, consisting of three or more small riblets raised to form a large rib; the interior is ridged to correspond with the external sculpture; posterior ears small, slopingly cut away; anterior ears large and projecting, so that the whole shell is somewhat oblique; that of the right valve deeply notched, all of them covered with scabrous ribs. Color whitish yellow, orange, reddish, or purplish; sometimes uniform in coloring, often beautifully maculated with red, purple, or brown.

Length, 20; height, 23; diameter, 8 mm. Mayaguez, Porto Rico, a number of young valves.

A beautiful and variable little species, with an infinite variety of coloring. The valves are sometimes made quite rough by the sharp scales on the ribs.

Pecten lemniscatus Reeve.

Pecten lemniscatus Reeve, Conch. Icon., VIII, pl. XXXV, fig. 170 (see Errata), 1853.

Shell elevated, thin, somewhat fan-shaped, compressed, nearly equivalve and equilateral, with small, slopingly cut posterior and large, projecting anterior ears, that of the right valve with a large, deep, byssal notch; surface sculptured with numerous, rather low, unequal ribs and riblets, the principal ones sharply and often strongly scaly; valves with a well-defined radiating shoulder below the ears and ridged on the interior to correspond with the external sculpture; ears with small, feeble ribs, which are roughly scaly. Color very variable, much as in *P. ornatus*, but not so distinctly marked.

Length, 35; height, 40; diameter, 10 mm.

San Juan Harbor, Porto Rico, one young valve.

This species is close to *P. ornatus*, but differs in the ribs, which are rather low and are never separated by deep, excavated grooves. The color pattern is generally less distinct. *P. effluens* Dall is probably the same species, though *P. lemniscatus* is also found in Mauritius. The sculpture of the lower valve is generally more feeble than that on the upper valve.

Pecten sp.

A single right valve was obtained in Mayaguez Harbor of a form which seems to approach *P. darwini*, but is probably undescribed. The specimen is too young and imperfect to be described.

Pecten exasperatus Sowerby.

Pecten exasperatus Sowerby, Thes. Conch., p. 54, pl. XVIII, figs. 183–186, 1846.

San Juan, Porto Rico (Gundlach).

Pecten antillarum Recluz.

Pecten antillarum Recluz, Journ. de Conchyl., IV, p. 53, pl. V, fig. 1, 1853.

San Juan, Porto Rico (Gundlach).

Subgenus AMUSIUM Bolten, 1798.

Section **PROPEAMUSIUM** De Gregorio, 1883.

Pecten nanus Verrill & Bush.

Cyclopecten nanus Verrill & Bush, Trans. Conn. Acad. Sci., X, pp. 85, 92, pl. XVI, figs. 12–12*c*, 1897.

Shell very small, nearly orbicular, compressed, subequivalve, equilateral, with rather small, nearly equal ears; surface apparently smooth, but generally (in adult shells) seen to be sculptured with very fine, close riblets; in other specimens the sculpture consists of microscopic, concentric striæ; ears generally having delicate, radial sculpture, the anterior one on the right valve sometimes slightly cancellated; within there are generally exceedingly faint radial ridges. Color semitransparent whitish or horny, often clouded, mottled, or irregularly rayed with milky white.

Length, 5.5; height, 5.5; diameter, 1.75 mm.

Mayaguez; Porto Rico, many partly worn valves.

Pecten pourtalesianum Dall.

Pecten (Propeamusium) pourtalesianum Dall, Blake Report, I, p. 211, pl. IV, fig. 3, V, fig. 12, 1886.

Shell small, thin, compressed, suborbicular, with small, nearly even ears; right valve with well-developed concentric ridges; the left appearing smooth, but having microscopic, concentric lines and radiating riblets; within there are from nine to eleven slender, somewhat club-shaped, radiating ribs in each valve which do not extend to edge of shell. Color generally milky white and subtranslucent, the ribs showing through, but sometimes brownish or reddish brown and dotted with white.

Length, 13; height, 13; diameter, 2.5 mm.

There was a single specimen and a left valve obtained at Mayaguez Harbor of the var. *striatulum* Dall. (See Blake Report, I, p. 212.)

As in other allied species, the right valve is not completely calcified near the border and it collapses just outside of the ribs, so that its outer portion lies in contact with the left valve.

Family SPONDYLIDÆ.

Genus SPONDYLUS Linnæus, 1758.

Shell irregular, inequivalve, attached by the right valve, which has a triangular area, auriculate, with radial, generally spinous or foliaceous ridges; resilium in a central pit; hinge with two curved, interlocking teeth in each valve; adductor impression duplex.

Spondylus echinatus Martyn.

Ostrea echinata Martyn, Univ. Conch., II, fig. 154, 1784.

Shell with four to eight radial spinose ridges, which are sometimes small and narrow or they may be large and foliaceous; between the ridges are smaller ones, often bearing small spines, and in addition there is a third set of minute ridges, which are scaly and reticulated by the growth lines; lower valve often foliaceous, especially on earlier growth; border of valves dentate, often edged with yellow, orange, scarlet, or purple. Interior sometimes delicately iridescent. Color whitish yellow, or orange, scarlet, or purple. In the lighter-colored shells the beaks are often richly colored.

Length, 80; over all, 120; height, 90; over all, 120; diameter, 40; over all, 60 mm.

Boca Prieta; off Point Melones, Porto Rico.

Genus PLICATULA Lamarck, 1801.

Shell irregular attached by the beak of the right or left valve; valves plaited; hinge area obscure; resilium internal; right valve having a longitudinal cardinal on each side of the resilium and outside of these teeth a socket which receives the teeth of the other valve; muscular impressions single.

Plicatula gibbosa Lamarck.

Plicatula gibbosa Lamarck, Syst. An. sans Vert., p. 132, 1801.
Plicatula vexillata Guppy, Geol. Mag. Dec., II, vol. I, p. 444, pl. XVII, fig. 7, 1874.

Shell solid, irregular, somewhat fan-shaped, with strong, radiating, often divaricate plications, which end in serrations; whitish or brownish, commonly marked on the ribs with irregular, radiating, dark brown lines.

Length, 25; height, 25; diameter, 10 mm.

Aguadilla, Porto Rico, one valve.

This is the well-known *Plicatula ramosa* of Lamarck, but the name *gibbosa* was applied by him to the same species previously. It is often gregarious, and a half-dozen specimens are sometimes found attached to a single shell or to each other.

Family LIMIDÆ.

Genus LIMA (Bruguière) Cuvier, 1798.

Shell equivalve, compressed, white, obliquely oval, having rayed ribs or striæ, auriculate; anterior side generally straight, gaping; posterior side rounded, usually closed; hinge area triangular, with a central resilium; muscular impressions lateral, duplex, large.

Lima scabra Born.

Ostrea scabra Born, Test. Mus. Vind., p. 110, 1780.
Lima scabra Sowerby, Conch. Icon., XVIII, pl. II, fig. 8, 1872.

Shell nearly equilateral, being but slightly oblique, the hinge line nearly horizontal, decidedly gaping and reflexed at the upper, anterior portion, nearly closed posteriorly; hinge area low, triangular; cartilage triangular; surface covered everywhere with fine, radiating ridges, which are prickly-scaly; edges of the shell serrate by the sculpture. Epidermis brown.

Length, 45; height, 55; diameter, 17 mm.

Aguadilla; Ponce; Mayaguez Harbor, Porto Rico; Ensenada Honda, Culebra.

Lima scabra var. **tenera** Sowerby.

Lima tenera Sowerby, Thes. Conch., p. 84, pl. XXI, figs. 10, 11, 1846.

Shell subovate, subcompressed, thin, roughened with delicate scabrous ribs, which are somewhat interrupted; gaping anteriorly, the shell thickened at the opening.

A smaller, more delicate and more finely ribbed form than the typical *L. scabra*.

Mayaguez Harbor, Porto Rico, valves.

Lima lima Linnæus.

Ostrea lima Linnæus, Syst. Nat., ed. x, p. 699, 1758.
Lima squamosa Sowerby, Conch. Icon., XVIII, pl. II, fig. 10, 1872.

Shell solid, inequilateral, the anterior side straight and slightly gaping, the posterior side irregularly rounded, nearly closed; ears oblique; beaks elevated, having below them a low, triangular area and a triangular ligament. Surface sculptured with about thirty strong, radiating ribs, which are covered with large, rough, elevated scales; the ribs of the anterior and posterior portions not so strong or rough as are those of the rest of the shell; within the shell the ribs show distinctly and the edges of the shell are strongly dentate.

Length, 45; height, 55; diameter, 22 mm.

Mayaguez, Porto Rico.

Lima inflata Lamarck.

Lima inflata Lamarck, An. sans Vert., VI, p. 156, 1819.
Lima fasciata Sowerby, Conch. Icon., XVIII, pl. IV, fig. 17, 1872.

Shell very oblique, thin, inflated, with a wide, long gap before and behind, so that the valves touch only at the hinge and base; nearly straight in front, rounded on the base and posterior border, having a somewhat rounded angle about midway between the anterior base and the posterior ear; hinge line very oblique; area low, triangular, with a wide, triangular ligament; surface sculptured with rather low, delicate ribs, often with finer riblets between them, their edges somewhat roughened or nodulous; inner border of the shell scarcely serrate, interior showing traces of the ribs.

Length, 32; height, 40; diameter, 25 mm.

Mayaguez, Porto Rico; Ensenada Honda, Culebra.

Lima hians Gmelin.

Ostrea hians Gmelin, Syst. Nat., p. 3333, 1792.
Lima fragilis Sowerby, Conch. Icon., XVIII, pl. IV, fig. 18, 1872.

Aguadilla, Porto Rico (Gundlach).

Genus LIMATULA S. Wood, 1839.

Shell equilateral, or nearly so; valves closed, small; hinge edentulous.

Limatula subauriculata Montagu.

Pecten subauriculata Montagu, Test. Brit. Suppl., p. 63, pl. XXIX, fig. 2, 1808.
Lima subauriculata Jeffreys, Brit. Conch., II, p. 82; V, p. 169, pl. XXV, fig. 3.
Limatula subauriculata S. Wood, Mag. Nat. Hist., n. s., III, p. 236, pl. III, fig. 6, 1839. Crag Moll., II, p. 47, pl. VII, figs. 3 *a-c*, 1850.

Mayaguez Harbor, Porto Rico, at station 6062, in 25 fathoms; also northward to the Arctic seas.

Superfamily ANOMIACEA.

Family ANOMIIDÆ.

Genus ANOMIA (Linnæus, 1758) Müller, 1775.

Shell irregular, subcircular or oblong, often imitating the object to which it is attached; thin, subtransparent, the interior somewhat nacreous; left valve entire, convex, having a ligamental fossette below the summit and bearing four muscular impressions; right valve flat, having a large sinus on its upper border through which the pluglike byssus passes, and having a single muscular impression.

Anomia simplex d'Orbigny.

Anomia simplex d'Orbigny, Moll. Cubana, II, p. 367, pl. XXXVIII, figs. 31-33, 1845.

Shell irregular, fitting and often imitating the object to which it is attached, suborbicular, thin, semitransparent; left valve generally convex and thicker than the right, with an elongated ligamental fossette, one muscle scar just below the ligament, and three subcentral situated on an oblong callus; right valve generally flat or concave, with an oval opening for the byssal plug, which is surrounded by an oblong callus, on which there is a single muscle scar; interior of valves nacreous and shining; exterior having concentric scaly ridges. Color whitish, silvery, greenish straw, or pale brownish.

Height, 35; length, 35; diameter, 7 mm.

Mayaguez, Porto Rico.

Genus PODODESMUS Philippi, 1837.

Shell with the appearance of *Anomia*, but the left valve with only two muscular impressions.

Pododesmus rudis Broderip.

Placunanomia rudis Broderip, P. Z. S., 1834, p. 2.
Placunanomia rudis Reeve, Conch. Icon., XI, pl. I, fig. 2, 1859.

Shell very irregular, compressed, suborbicular, oval, oblong or somewhat elongate, moderately solid; lower valve normally flatter than the upper; byssal opening round oval or closed in old specimens; surface wide, with irregular, broken, rather fine ridges crossed by scaly or foliaceous growth lines; within shining, the lower valve generally having a brown blotch in its center. Color whitish or greenish.

Length, 40; height, 40; diameter, 6 mm. Length of another specimen, 30; height, 35; diameter, 4 mm.

Aguadilla; San Juan Harbor; off Point Melones, Porto Rico.

Superfamily MYTILACEA.

Family MYTILIDÆ.

Genus MYTILUS (Linnæus, 1758) Bolten, 1798.

Section HORMOMYA Mörch, 1853.

Shell wedge-shaped, rounded behind, with terminal beaks, plicately sculptured; hinge teeth minute or obsolete; pedal impressions two in each valve; anterior adductor impression small, placed under the beaks; posterior adductor elongated, placed at the posterior end of the shell.

Mytilus hamatus Say.

Mytilus hamatus Say, Journ. Acad. Nat. Sci. Phila., II, p. 265, 1822; Binney's Say, pp. 91, 204, pl. L, fig. 18.

Shell irregularly triangular, rather solid, elongated and generally falcate, the anterior side being usually incurved, the posterior side angular where it joins the hinge; there is a more or less prominent rounded ridge back of the anterior part of the shell, and the radiating ribs with which the whole shell is sculptured spread from this ridge, curving to the front and the back of the shell; these ribs are numerous and somewhat bifurcate; they are finely beaded and often wavy; inner border of the shell crenulate. The thick epidermis is blackish or brownish, sometimes tinted green and sometimes a little tawny; the interior is usually dark violet, with a lighter border.

Length, 30; height, 50; diameter, 19 mm.

San Juan, Porto Rico; Ensenada Honda, Culebra; Sailrock, between Culebra and St. Thomas.

These specimens are more delicate and less curved than the ordinary manifestation of this species.

Mytilus exustus Linnæus.

Mytilus exustus Linnæus, Syst. Nat., ed. x, p. 705, 1758.
Mytilus striatulus Schröter, Einleitung, III, p. 419, pl. IX, fig. 16.

Shell small, rather solid, inflated, irregularly triangular, somewhat elongated; beaks curved inward and forward; there is a high, rounded ridge beginning at the beaks, then curving backward, then downward and forward to the posterior base of the shell; the surface is sculptured with numerous curved ribs, which follow the course of the ridge and curve each way from it to the anterior and posterior sides; these ribs are beaded and somewhat bifurcated; at the byssal region in front there is a somewhat smooth area; the growth lines are often deeply impressed at intervals. Color brownish, blackish and tawny, often somewhat clouded.

Length, 10; height, 18; diameter, 10 mm.

Puerto Real; Hucares; Ponce; San Juan, Mayaguez, Porto Rico; Ensenada Honda, Culebra.

Genus MODIOLUS Lamarck, 1799.

Shell much as in *Mytilus*, but the beaks are not terminal; there are no hinge teeth; the epidermis is hirsute, and the animals generally nestle in a mass of byssal fibers. The valves have usually, if sculptured, a smoother central area.

Section MODIOLUS s. s.

Modiolus tulipus Lamarck

Modiola tulipa Lamarck, An. sans Vert., vi, p. 111, 1819; Reeve, Conch. Icon., x, pl. iv, fig. 15, 1857.

Shell subtrapezoidal, somewhat elongated, inflated, subsolid, with a faint posterior wing; a nearly straight rounded posterior ridge runs from the beaks to the posterior base of the shell; in front of this ridge the base is slightly incurved; epidermis somewhat concentrically striate, covered with a scaly growth, which develops into bristly hairs that part near the byssus, smooth. There is generally a broad reddish stripe on the posterior ridge, with a lighter one in front of it, though this area and the posterior part may be radiately banded red and white in narrow streaks. The anterior part of the shell is often a chestnut or burnt brown.

Length, 85; height, 40; diameter, 40 mm.

San Juan; Boca Prieta; Mayaguez Harbor, Porto Rico.

Section AMYGDALUM Megerle, 1811.

Modiolus arborescens Dillwyn.

Mytilus arborescens Dillwyn, Descr. Catalogue Rec. Shells, i, p. 306. 1817.
Modiola arborescens Reeve, Conch. Icon., x, 1857, pl. vi, fig. 30.

Shell very thin, slightly inflated, long-obovate, smooth except for faint growth lines, brilliant; beaks low; posterior ridge scarcely developed. Color pale straw or ashy, lighter on the posterior ridge, the posterior slope being beautifully marked with arborescent, blackish lines. Sometimes this area is marked so that the dark lines inclose various-sized, triangular spots of the color of the shell.

Length, 50; height, 20; diameter, 13 mm.

Mayaguez; San Juan, Porto Rico.

An exceedingly delicate and beautiful species.

Section BOTULA Mörch, 1853.

Modiolus cinnamomeus Lamarck.

Mytilus cinnamomeus, etc., Chemnitz, Conch. Cab., viii, p. 152, pl. lxxxii, fig. 371, 1785.
Modiola cinnamomea Lamarck, An. sans Vert., vi, p. 114, 1819.

Shell small, nearly smooth, subrhomboidally and somewhat elongated, slightly arcuate, inflated, with a thick, dark chestnut epidermis, which shows distinct, often dark, rest periods, and is darker colored at the posterior end and anterior base; beaks full and high, placed at the upper anterior extremity of the shell and projecting in front of the anterior end; hinge line curved, the line extending around to the anterior base in an unbroken curve.

Length, 10; height, 5; diameter, 6 mm.

Mayaguez Harbor, Porto Rico, one shell.

Section GREGARIELLA Monterosato, 1884.

Modiolus coralliophagus Gmelin.

Mytilus coralliophagus Gmelin, Syst. Nat., p. 3359, 1792.

Shell small, oblong, much inflated, varying much in form, generally higher and more inflated in front, with a high posterior ridge, from which radiating striæ curve backward and downward, those on the posterior slope stronger, crossed by heavy growth lines and subnodulous, those in front of the ridge fine and unbroken; from the beaks to about the center of the base there is a constriction, and in front of this there is a space without radial sculpture but showing plainly concentric lines; at the rounded anterior end there are fine radiating ribs; beaks curved inward and forward, placed at the extreme anterior end; the inner edges of the shell are finely serrate. Color dirty white or brownish.

Length, 20; height, 8; diameter, 9 mm.

Mayaguez; Guanica; Boqueron Bay; Arroyo, Porto Rico; Ensenada Honda, Culebra.

This species nests in coral sand and frequently has a part of the nest attached, especially at the posterior ridge. It is the *Botula semen* of authors and the *Modiola opifex* of Say.

Genus LITHOPHAGA Bolten, 1798.

Shell cylindrical, having a thick epidermis, the low beaks placed at or near rounded anterior end; posterior end pointed or wedge-shaped; hinge line linear, without teeth; ligament marginal, internal.

Section LITHOPHAGA Bolten, s. s.

Lithophaga antillarum d'Orbigny.

Lithodomus antillarum d'Orbigny, Moll. Cubana, II, 1847, p. 332, pl. XXVIII, figs. 12, 13.

Shell elongated, rounded in front and behind, wedge-shaped when viewed from above; the beaks placed at the extreme upper anterior border; surface sculptured with concentric furrows, especially the posterior part; the anterior and anterior basal portion having fine vertical ribs which fade out at the extreme anterior end of the shell; epidermis rich dark chestnut, becoming almost black at the posterior end and anterior base.

Length, 30; height, 10; diameter, 8 mm.

Puerto Real; Guanica; Arroyo, Porto Rico.

Section DIBERUS Dall.

Lithophaga bisulcata d'Orbigny.

Lithodomus bisulcatus d'Orbigny, Moll. Cubana, II, p. 133, pl. XXVIII, figs. 14–16, 1845.

Shell elongated, subcylindrical, the anterior and posterior ends rounded, the latter with two faint, radiating sulcations, one above and the other below the low rounded posterior ridge; growth lines somewhat impressed, especially on the posterior portion, otherwise the shell itself is smooth and shining, the epidermis being a light chestnut color; beaks low, anterior, but not at the extreme end of the shell. The greater part of the surface of the shell is covered with a calcareous incrustation, which is thin in front and thick behind, and is especially strong on the posterior ridge; its surface is partly covered with fine wrinkles or corrugations, and it is pointed behind.

Length over all, 30; of shell, 25; height, 10; diameter, 8 mm.

Guanica; Puerto Real; Arroyo, Porto Rico.

Genus CRENELLA Brown, 1827.

Shell oval or rhomboidal, with a thick epidermis; surface sculptured with longitudinal ana concentric striæ; beaks straight; ligament small; hinge area crenulate.

Crenella divaricata d'Orbigny.

Nuculocardia divaricata d'Orbigny, Moll. Cubana, II, p. 311, pl. XXVII, figs. 56–59, 1845.

Shell small, equilateral, solid, inflated, with an elliptical outline; umbonal region high, the beaks straight, curved in to the hinge line; surface sculptured by delicate radial ribs, which are somewhat divaricate along a line from the beaks to the middle base; near the anterior and posterior there is a curved rib, and from this the ribs in front and behind are sharply divaricate; there is also delicate concentric sculpture, which causes the ribs to appear as if slightly beaded; inner edge crenate throughout. Color brownish yellow.

Length, 3; height, 3.5; diameter, 3 mm.

Mayaguez, Porto Rico, several worn valves.

Genus MODIOLARIA Beck, 1840.

Shell rhomboid, inflated, generally with three areas on the disk, the two at the ends radially sculptured, that of the center smooth or only feebly radially sculptured; sometimes the surface is radiately ribbed throughout or it may be smooth; beaks incurved, placed near the anterior end. The genus is close to *Crenella* and differs from it principally in anatomical characters.

Modiolaria lateralis Say.

Mytilus lateralis Say, Journ. Acad. Nat. Sci. Phila., II, p. 264, 1822.

Shell small, long-rhomboid, inflated, subsolid; umbonal region full; beaks curved forward, projecting slightly in front of the anterior end of the shell; surface sculptured with fine, concentric growth lines throughout, anterior and posterior areas sculptured with fine, beaded ribs, the posterior area wide and including the rounded posterior ridge; the anterior area narrow; central area slightly depressed and showing only concentric striæ; inner edge crenate, except at the ligamental and central areas. Color greenish or reddish, often marbled with brown.

Length, 6; height, 3.5; diameter, 3 mm.

San Juan Harbor; Mayaguez, Porto Rico; Vieques, and off Vieques.

Order TELEODESMACEA.

Superfamily MYACEA.

Family GASTROCHÆNIDÆ.

Genus GASTROCHÆNA (Spengler) Cuvier, 1817.

Shell regular, equivalve, inequilateral, ovoid, with the beaks anterior, widely gaping at the anterior base. Sculpture concentric. The animal forms flask-shaped excavations in shells, corals, and coral rocks; sometimes it is without a burrow, when it forms a shelly, inclosing tube covered with extraneous material.

Gastrochæna cuneiformis Spengler.

Gastrochæna cuneiformis Spengler, Nova Act. Soc. Hafn., II, p. 179, figs. 8-11, 1788.

Shell much inflated, subsolid, subovate or pear-shaped, gaping excessively at the anterior base, the gap narrowing and extending nearly or quite to the posterior end; beaks low, placed at the extreme anterior part of the shell, which is narrow and sharply angular below at the gap; there is sometimes a wide, shallow depression running from the beaks to the posterior base; sculpture rudely, irregularly concentric. Color white.

Length, 18; height, 10; diameter, 8 mm.

Several specimens in coral, Mayaguez, Porto Rico.

Family SAXICAVIDÆ.

Genus SAXICAVELLA Fischer, 1870.

Shell small, equivalve, thin, inequilateral, gaping, subtrapezoidal, obliquely angular behind; hinge with a subobsolete tooth in the right valve, fitting into a cavity in the left cardinal margin; ligament short, prominent; pallial line with a wide shallow sinuosity.

Saxicavella sagrinata, n. sp. Plate 55, fig. 16.

Shell small, rounded triangular, compressed, umbones small, flattened; anterior end shorter; surface irregularly concentrically undulated as if by stages of growth, dull, minutely granular or sagrinate, as if dusted; form as figured, with no defined angle or carina extending downward and backward from the umbo; periostracum very thin, pale yellowish, hardly discernible; the substance of the shell subtranslucent; interior polished; hinge with a single obscure tooth in front of a small nymph for the ligament.

Length, 5.5; height, 3.7; diameter, 2 mm.

One right valve at station 6062, Mayaguez Harbor, Porto Rico, in 30 fathoms, sand.

This species is shorter, more compressed, and less angular than the *S. plicata* of Europe; it somewhat resembles a *Basterotia*, but has a different hinge.

Family CORBULIDÆ.

Genus CORBULA (Bruguière) Lamarck, 1797.

Valves unequal, the right usually larger, both more or less beaked behind; in the right valve there is a single, large tooth below the beak, with a deep resiliary pit behind it and no lateral laminæ; left valve with a deep pit below the beak, into which the tooth of the right valve falls, having an elevated process in front of it and sometimes a sort of tooth behind the pit; beaks prominent, that of the right valve usually superior to that of the left; sculpture often discrepant; pallial line with or without a sinus.

Section ALOIDIS Megerle, 1811.

Corbula disparilis d'Orbigny.

Corbula disparilis d'Orbigny, Moll. Cubana, II, p. 283, pl. XXVII, figs. 1-4, 1845.

Shell solid, very inequivalve, the right valve gibbous, with a very high beak, which is curved inward and forward, and a high, sharp, posterior ridge sculptured with strong concentric ridges which mostly fade out on the posterior slope; hinge tooth small, placed well forward; ligamental pit large; left valve much smaller and less convex than the right, having faint, concentric sculpture and few to rather numerous radiating ribs which do not reach to the beak, which often look like cracks in the shell; it is covered with a thick epidermis, which is thinner above and shows the sculpture in an exaggerated way; pallial line with a wide shallow sinus. Color grayish, whitish, or purplish.

Length, 9; height, 7; diameter, 5 mm.

Mayaguez Harbor; San Juan, Porto Rico.

Section CUNEOCORBULA Cossmann, 1886.

Corbula dietziana C. B. Adams.

Corbula dietziana C. B. Adams, Contr. to Conch., XII, p. 235, 1852; Dall, Bull. U. S. Nat. Mus., No. 37, p. 70, pl. II, figs. 7 *a–c*, 1889.

Shell solid, triangular, distorted, moderately inequivalve at first, afterwards very inequivalve, somewhat inequilateral, rounded in front, with a high, sharp, posterior ridge on the left valve that ends in a point at the posterior base; in the first stage of growth there are low, wide, concentric ridges, with fine radiating riblets in their interstices; the concentric ridges of the second stage of growth are finer, and this part of the shell is rayed with whitish and reddish or purplish rays; in the second stage the small valve is merely striated; beaks prominent, turned inward and forward; the umbonal region is somewhat flattened; teeth rather strong.

Length, 13; height, 9; diameter, 5 mm.

Mayaguez Harbor, Porto Rico, one left valve.

Corbula swiftiana C. B. Adams.

Corbula swiftiana C. B. Adams, Contr. to Conch., p. 236, 1852; Dall, Blake Report, I, pl. II, figs. 5 *a–c*, 1886.

Shell subsolid to solid, triangular, nearly equilateral, inequivalve; posterior ridge sharp and well developed in each valve, ending in a sharp beak at the posterior base; younger shell nearly smooth, concentric striæ becoming stronger as the shell grows older, and having faint radial riblets; beaks rather sharp, prominent; teeth moderately strong. Color whitish.

Length, 9; height, 7; diameter, 4 mm.

Mayaguez, Porto Rico, a great number of worn valves; off Puerto Real, one entire specimen, a somewhat inflated variety.

Corbula æquivalvis Philippi.

Corbula æquivalvis Philippi, Arch. für Naturg., II, p. 227, pl. VII, fig. 4, 1836.
Corbula cubaniana d'Orbigny, Moll. Cubana, II, p. 283, pl. XXVI, figs. 51–54, 1845.
Corbula knoxiana C. B. Adams, Dall, Blake Report, I, pl. I, figs. 3, 3 *a–c*, 1886.

Shell solid, elongate-triangular, nearly equilateral, with a strong, sharp, posterior ridge, behind which the margin is decidedly truncated; in fact it is sunk below the posterior ridge until it almost becomes a lunule; beaks curved inward and forward; surface sculptured with strong, rather regular, rounded, concentric ridges, that of the posterior slope has finer ridges; tooth of right valve strong and curved upward; that of the left bifid. Color whitish.

Length, 10; height, 7; diameter, 5.5 mm.

Beach at Mayaguez, Porto Rico, one broken valve.

Corbula caribæa d'Orbigny.

Corbula caribæa d'Orbigny, Moll. Cubana, II, p. 284, pl. XXVII, figs. 5–8, 1845.

Shell solid and much inflated when fully adult, thinner and subcompressed when immature, subtriangular, drawn out into a decided point behind; beaks rather full, curved inward and forward; surface sculptured with rather strong, irregular, concentric ridges, those of the lunule-like posterior slope finer. In addition there are scattered, very narrow, radiating threads on the surface. On the base there is a wide, flattened area where the valves join that is scarcely sculptured; the right valve incloses the left, and throughout its posterior portion it projects widely over the left; beak cavities deep; teeth rather strong. There is a well-marked posterior sinus. Color whitish.

Length, 16; height, 10; diameter, 10 mm.

Mayaguez, Porto Rico, two shells, one immature and one fully adult.

Family MYACIDÆ.

Genus SPHENIA Turton, 1822.

Shell inequivalve, inequilateral, irregular rostrate behind, roughened; right valve a little larger than the left, having a single small tooth in front of the resilium pit; muscle impressions large; pallial line feeble.

Sphenia antillensis, n. sp. Plate 55, fig. 14.

Shell small, subquadrate, rather compressed, white, covered with a yellowish periostracum; surface dull, sculptured only by incremental lines and a low obscure thread running from the umbo backward and downward; shell thin, interior white, polished; hinge normal, general form as figured.

Length, 4; height, 2.5; diameter, 1.5 mm.

One perfect shell, Playa de Ponce, Porto Rico.

There is nothing striking in the characters of this little shell, but it does not seem identifiable with any of the other species. The species from Cuba referred to this genus by d'Orbigny are referable to the genus *Cuspidaria*.

Superfamily **MACTRACEA**.

Family MACTRIDÆ.

Subfamily MACTRINÆ.

Genus **MACTRA** (Linnæus, 1758), Lamarck.

Mactra fragilis Gmelin.

Mactra fragilis Gmelin, Syst. Nat., p. 3261, 1792.
Mactra fragilis Reeve, Conch. Icon., VIII, pl. XI, fig. 47, 1854.

Mayaguez, Porto Rico (Gundlach).

Mactra alata Spengler.

Mactra alata Spengler, Skrivt. Nat. Selsk., V, pt. 2, p. 99.
Mactra alata Reeve, Conch. Icon., VIII, 1854, pl. VIII, fig. 29.

Mayaguez, Porto Rico (Gundlach).

Family MESODESMATIDÆ.

Subfamily ERVILIINÆ.

Genus **ERVILIA** Turton, 1822.

Shell small, concentrically striate, sometimes brightly colored; ligament obsolete; resilium small; laterals small; dorsal anterior lamina absent, the ventral more or less coalescing with the anterior arm of the right cardinal; left cardinal large, bifid; pallial sinus well marked.

Ervilia concentrica Gould. Plate 58, fig. 12.

Ervilia concentrica Gould, Otia Conch., p. 329; Proc. Boston Soc. Nat. Hist., VIII, p. 280, 1862.

Shell small, scarcely inflated, long-triangular, the posterior end narrower; beaks rather high but not full; surface finely, concentrically ridged, and having more delicate radial riblets which are most conspicuous on the anterior end; right valve with a single triangular tooth in front of the small, triangular resilium and a feeble one behind it; left valve with a double cardinal; pallial sinus faint, deep. Color whitish or pink.

Length, 5; height, 3.5; diameter, 2 mm.

San Juan; Mayaguez, Porto Rico, a number of worn valves. Off Georgia (Gould).

Superfamily **SOLENACEA**.

Family SOLENIDÆ.

Genus **PSAMMOSOLEN** Risso, 1826.

Shell transversely oblong, gaping at the extremities, obliquely sculptured, more or less invested with an epidermis; beaks subcentral; upper and lower shell margins nearly parallel; one or sometimes two cardinal teeth in each valve; ligament prominent; pallial impression large.

Psammosolen sanctæ-marthæ d'Orbigny.

Solen sanctæ-marthæ Chemnitz, Conch. Cab., XI, p. 203, pl. CXCVIII, fig. 1938, 1795; d'Orbigny, Moll. Cubana, II, p. 232, pl. XXV, figs. 31, 32, 1845.

Shell long-quadrate, gaping widely at each end, the valves only touching at the hinge and central base; beaks low; ligament extending in front of and behind the beaks, inflated into a rounded ridge immediately behind them and then suddenly flattened; growth lines rather rude; all the shell except its extreme anterior portion is obliquely sculptured, the ridges dividing on the low, rounded posterior ridge; epidermis yellowish or horn-colored, wearing off except around the margin of the shell; left valve with one high, compressed cardinal just behind the beak; right valve with a similar cardinal under the beak; pallial sinus wide and deep. Color whitish.

Length, 37; height, 20; diameter, 12 mm.

Mayaguez, one young broken valve.

There are sometimes vestiges of a second cardinal in each valve.

Genus SOLEN Linnæus, 1758.

Shell very long, subcylindrical; the dorsal and ventral edges parallel, inequilateral, straight or nearly so; surface more or less sculptured with the growth lines; divided by an oblique line running from the beaks to the post base; extremities widely gaping; hinge with a single cardinal in each valve; ligament elongated, external; anterior muscle impression elongated, parallel with the dorsal border, pallial sinus short.

Section SOLENA Mörch, 1853.

Solen obliquus Spengler.

Solen obliquus Spengler, Skrift. Nat. Selsk., III, p. 104, 1794.
Solen ambiguus Sowerby, Conch. Icon., XIX, pl. V, fig. 21, 1874.

Shell rather solid, subcylindrical, straight, the beaks placed at one-sixth of the length of the shell from the anterior end; anterior end obliquely truncated, longer below; the shell is decidedly thickened at this part and appears as if cut off; posterior end nearly squarely truncate, thin; epidermis rudely wrinkled, growing beyond the shell, ashy or brownish; there is one high, straight tooth in each valve under the beaks, that of the right valve in front of the one in the left; anterior muscle scars elongate, placed under the beaks; posterior scars semilunar, the dorsal edge straight, the wide pallial line connecting with the center of its base and forming a <; in the fork of this is the small pallial sinus.

Length, 110; height, 22; diameter, 14 mm.

Cabo Rojo light, Porto Rico, one specimen.

Superfamily TELLINACEA.

Family PSAMMOBIDÆ.

Genus HETERODONAX Mörch, 1852.

Heterodonax bimaculatus Linnæus.

Tellina bimaculata Linnæus, Syst. Nat., ed. X, p. 677, 1758; Sowerby, Conch. Icon., XVII, 1866, pl. XVIII, fig. 94 *a–c*.

San Juan, Porto Rico (Gundlach).

Genus TAGELUS Gray, 1847.

Tagelus gibbus Spengler.

Solen gibbus Spengler, Skrift. Nat. Selsk., III, p. 104, 1794.
Solecurtus caribæus Sowerby, Conch. Icon., XIX, pl. IV, fig. 21, 1874.

Mayaguez, Porto Rico (Gundlach).

Genus ASAPHIS Modeer, 1793.

Shell transverse, somewhat rhomboid, subequilateral, beaks rather prominent; hinge having two cardinals in each valve, the anterior in the left and the posterior in the right bifid; ligament thick; adductor scars near the dorsal edge; pallial sinus deep, rounded.

Asaphis coccinea Martyn.

Cardium coccinea Martyn, Univ. Conch., No. 135, pl. 135, 1784: Ed. Chenu, pl. 41, fig. 2: Mörch, Journ. de Conchyl., VII, p. 140, 1858.

Shell oblong, subrhomboid, somewhat inflated, subsolid, with rather full, high beaks, with a well-developed, rounded posterior ridge; the surface is covered with numerous radiating, wavy ribs which are stronger on the posterior slope and are generally somewhat cancellated at the anterior and posterior ends by the crossing of the growth lines; they are sometimes a little scaly at the hinder part of the shell; nymph rather narrow but deep; pallial sinus large, rounded. Color whitish, straw colored, salmon, reddish or violet, sometimes faintly rayed; within white, straw colored, yellow, red, or violet; the hinder part of the interior and nymphs almost always deep violet.

Length, 70; height, 45; diameter, 32 mm.; length of another, 90; height, 60; diameter, 43 mm.

Fajardo; Ponce Reefs, Porto Rico; Ensenada Honda, Culebra.

Family DONACIDÆ.

Genus DONAX Linnæus, 1758.

Shell inequilateral, triangular; anterior side longer than the posterior which is short and obliquely truncated; border of the valves generally crenated; hinge having in the right valve one anterior lateral and two cardinals, the posterior bifid, and a short posterior tooth. The left valve has a faint anterior lateral and two cardinals, with sometimes a small intermediate tooth and one posterior lateral; ligament short; sinus deep, rounded.

Section CHION Scopoli, 1777.

Donax denticulata Linnæus.

Donax denticulata Linnæus, Syst. Nat., ed. x, p. 683, 1758; Reeve, Conch. Icon., VIII, pl. VII, figs. 48 *a*, *b*, 1854.

Shell solid, subinflated, long triangular, inequilateral, the anterior and posterior dorsal lines straight, the anterior end narrow and rounded, the base line slightly curved, with a faint angulation near its center; ligament short, small; surface covered with fine radiating ridges; these ridges are flattened except at the posterior part of the shell and are peculiarly serrate on their edges; posterior ridge double, the anterior part sharply angled, the area between the two angles ribbed and delicately sculptured between the ribs; posterior slope sculptured with rather strong oblique ridges, and between them are fine, raised, radial threads; inner edge of the shell dentate; pallial sinus deep. The range of color is great; white, straw, salmon, brown, and violet, variously and often brightly rayed.

Length, 28; height, 19; diameter, 11 mm.

Aguadilla; San Juan Harbor; Mayaguez, Porto Rico. A great number of beautiful living specimens were obtained at Mayaguez.

Genus IPHIGENIA Schumacher, 1817.

Shell subsolid, subtriangular, subequilateral; inner edge of the valves smooth; hinge with two cardinals in each valve, the posterior in the right and the anterior in the left bifid; laterals wanting; ligament external; pallial sinus deep, rounded.

Iphigenia brasiliensis Lamarck.

Capsa brasiliensis Lamarck, An. sans Vert., V, p. 553, 1818; figured in Enc. Méth., pl. CCLXI, fig. 10.

Shell rather solid, subinflated, the beaks a little nearer to the posterior ends, of a somewhat triangular or rhomboid form; posterior ridge moderately developed, ending in a blunt point at the posterior base; from this the basal line runs forward parallel with the anterior dorsal line to the center of the shell, from which it curves upward to the anterior point; surface showing the growth lines and having fainter, radial sculpture; epidermis smooth, livid or greenish ash color, often wearing off in old specimens; posterior cardinal of the right valve triangular, bifid; anterior cardinal narrow, and there is sometimes a low posterior lateral; anterior cardinal of left valve oblique, bifid, the left lamellar; interior whitish or purplish, the teeth often violet.

Length, 60; height, 40; diameter, 23 mm.

Catano, San Juan Harbor, Porto Rico, one specimen. Other specimens were bought in San Juan at the market.

Family SEMELIDÆ.

Genus SEMELE Schumacher, 1817.

Shell suborbicular or elliptical, slightly inequivalve; beaks small, curved forward; two cardinals in each valve; two distinct laterals in the right valve; resilium oblique, internal; ligament short; muscle scars large; sinus deep.

Semele proficua Pulteney.

Tellina proficua Pulteney, in Hutchin's Dorset, p. 29, pl. V, fig. 4, 1799.
Amphidesma reticulata Reeve, Conch. Icon., VIII, pl. V, fig. 29, 1853.

Shell nearly equilateral, a little longer in front, suborbicular, a little longer than high, subsolid and subinflated; ligament small, placed in a sort of escutcheon; there is a decided lunule in front of the beaks; the posterior part of shell is slightly flexed; surface sculptured with rather strong, concentric growth lines; these are sometimes elevated into ridges and have fine radial striæ which give it a somewhat wrinkled appearance; left valve with two direct compressed cardinals, the anterior the larger, and two laterals; resilium pit deep; right valve with two cardinals, the hinder the larger, and two strong laterals. Color whitish, straw, or purplish, sometimes variegated.

Length, 30; height, 27; diameter, 14 mm.

San Juan, Porto Rico, one young specimen.

Semele purpurascens Gmelin.

Venus purpurascens Gmelin, Syst. Nat., p. 3288, 1792.
Tellina obliqua Wood, Gen. Conch., pl. XLI, figs. 1, 2, 1815.

San Juan, Porto Rico (Gundlach).

Semele bellastriata Conrad.

Amphidesma bellastriata Conrad, Journ. Acad. Nat. Sci. Phila., VII, p. 239, pl. XX, fig. 1, 1837.
Amphidesma cancellata d'Orbigny, Moll. Cubana, II, p. 241, pl. XXV, figs. 42–44, 1845.

Shell compressed, elliptical, the anterior side much the longer; surface covered with distinct, radiating ribs which are crossed by rather strong, concentric ridges that often form small tubercles where they meet the ribs; left valve with a strong bifid cardinal, with a faint lamellar one in front of it and two faint laterals; right valve with two cardinals, the posterior larger and slightly bifid, and two elongated, elevated laterals; pallial sinus deep and rounded. Color ashy purple, often rayed violet within.

Length, 25; height, 20; diameter, 9 mm.

Mayaguez, Porto Rico, one young, worn valve.

Section SEMELINA Dall, 1900.

Semele nuculoides Conrad.

Amphidesma nuculoides Conrad, Am. Journ. Sci., XLI, p. 347, 1841; Fos. Medial Tert., p. 73, pl. 41, fig. 6, 1845.

Shell small, solid, ovate, subcompressed, the beaks near to the anterior end; surface covered with fine, sharp, concentric ridges and a delicate, straw-colored epidermis; left valve with two divergent cardinals, the posterior slightly bifid, and a faint anterior lateral; right valve with two cardinals, the posterior bifid, and two strong laterals; pallial sinus large and rounded.

Length, 4.5; height, 3; diameter, 1.5 mm.

San Juan Harbor; Mayaguez, Porto Rico.

Genus ABRA (Leach) Lamarck, 1818.

Shell rather compressed, oval, subtriangular or subquadrate, whitish, shining, smooth; posterior side shortest; resilium lodged in a cardinal pit; right valve with two cardinals and generally two lamellar laterals; left with one cardinal and sometimes a rudiment of a posterior lateral.

Abra æqualis Say.

Amphidesma æqualis Say, Journ. Acad. Nat. Sci. Phila., II, p. 307, 1822: Am. Conch., III, pl. XXVIII, 1831.

Shell somewhat quadrate, subinflated, rather thin; beaks nearer the posterior end which is subtruncated above; surface with delicate growth lines; smooth, dirty yellowish white, scarcely shining; left valve with one strong cardinal, a vestige of a second in front, and no laterals; right valve with one cardinal and a feeble one behind it, without laterals; pallial sinus deep.

Length, 10; height, 8; diameter, 4 mm.

Mayaguez Harbor, Porto Rico.

Abra lioica Dall.

Syndosmya lioica Dall, Bull. Mus. Comp. Zool., IX, p. 133, 1881.
Abra lioica Dall. Blake Report, I, pl. IV, fig. 8, 1886.

Shell subquadrangular, thin, rather inflated, with full, prominent beaks, with faint growth striæ; smooth, whitish, and shining; posterior end subtruncate from above, and the beaks are considerably nearer to this end; the shell is faintly flexed to the right behind; the anterior end is broadly rounded; left valve with one strong cardinal and a small one behind, with no laterals; right valve with two rather strong, divergent cardinals and no laterals.

Length, 7; height, 4.5; diameter, 3.5 mm.

Mayaguez, Porto Rico.

More inequilateral and inflated, and with higher beaks than *A. æqualis*, and a more polished species.

Abra longicallus Scacchi.

Tellina longicallus Scacchi, Notiz., p. 16, pl. I, fig. 7, 1836.

Shell elongately subtriangular, thin, subcompressed, nearly equilateral, the beaks a little nearer to the posterior end, which is bluntly pointed and turned a little to the left; surface with delicate incremental striæ and faint vestiges of radial striæ; smooth and shining, straw-colored; there is a faint lunule in front, and the low, almost sharp, posterior ridges inclose a slight depression behind, in which is situated the small ligament; there is a single somewhat bifid cardinal in the left valve and vestiges of two laterals; the right valve has two divergent cardinals and two well-developed laterals; behind the beaks there is a short nymph; resilium small.

Length, 25; height, 17; diameter, 8 mm.

Mayaguez, Porto Rico.

Genus CUMINGIA Sowerby, 1833.

Shell triangular or transversely oval, rounded in front, subrostrate and slightly gaping behind, sometimes a little irregular, generally sculptured with concentric lamellæ, flexuous behind; hinge with a small cardinal in each valve and two elongated laterals, having a spoon-shaped resilium pit; pallial sinus wide.

Cumingia (tellinoides Conrad, var.?) **coarctata** Sowerby.

Cumingia tellinoides Conrad, Journ. Acad. Nat. Sci. Phila., VI, p. 258, pl. IX, figs. 2, 3, 1830.
Cumingia coarctata Sowerby, P. Z. S., 1833, p. 34.

Shell often irregular, with the dorsal and basal lines nearly parallel, the anterior end rounded, the posterior end obliquely truncated from above, ending at the posterior base in a blunt point, subsolid, subinflated, gaping a little behind; posterior ridge well defined, rounded; the ligament is scarcely discernible; the surface is covered with raised concentric threads or lamellæ, whitish; beaks pointed, a little nearer the posterior end; under the beaks in each valve there is a spoon-shaped resilium pit; in front of it in the left valve is a compressed cardinal, and there are two faint laterals in this valve; right valve with a double cardinal behind the pit and having two strong laterals.

Length, 21; height, 14; diameter, 8 mm.

San Juan Harbor, two young valves.

The variety is confined to the Antilles and may eventually be proved to be a distinct species.

Family TELLINIDÆ.

Genus TELLINA (Linnæus, 1758), Lamarck.

Shell subequivalve, rather compressed, suborbicular or transversely elongated, obliquely flexed behind; beaks subcentral; hinge with two cardinals and generally two laterals in each valve, one lateral anterior and one posterior, the laterals most distinct in the right valve; pallial sinus wide and deep; ligament external, prominent.

Section LIOTELLINA Fischer.

Tellina radiata Linnæus.

Tellina radiata Linnæus, Syst. Nat., ed. x, p. 675, 1758; Sowerby, Conch. Icon., XVII, pl. III, fig. 86, 1866.

San Juan; Aguadilla, Porto Rico (Gundlach).

Subgenus Arcopagia Leach, 1827.

Section CYCLOTELLINA Cossmann, 1886.

Tellina fausta Donovan.

Tellina fausta Donovan, Nat. Hist. Brit. Shells, p. 10, pl. xxv, figs. 13, 14, 180.

Mayaguez, Porto Rico (Gundlach).

Section PHYLLODINA Dall, 1900.

Tellina persica, n. sp. Plate 55, fig. 1.

Shell small, rather thin, compressed, white, suffused with apricot yellow, paler on the umbones; form as figured; umbones small, nepionic shell smooth, polished, glassy, remainder of the surface sculptured by concentric, narrow, rounded, low, adjacent ridges, which on the dorsal areas become lamellose but not much elevated, and on the anterior lunular margin form a series of rather inconspicuous serrations; on the anterior dorsal margin is a very narrow lunular depression, but the escutcheon is almost linear; interior brilliantly polished, pallial sinus free from the pallial line below, except for a very short distance, rising high in the middle of the valve, rounded but rather narrow in front; interior of the disk apricot color; hinge normal, ligament long, on a narrow nymph.

Length, 20.5; height, 13; diameter 5.5 mm.; the right valve slightly flatter than the left.

Mayaguez Harbor, Porto Rico, in 20 to 30 fathoms, sand, at stations 6062 and 6064.

This very elegant little shell resembles some of the Pliocene Tertiary species of the Antillean region, but there are no recent forms which approach it at all closely. It seems to be rather abundant.

Section MERISCA Dall, 1900.

Tellina lintea Conrad.

Tellina lintea Conrad, Journ. Acad. Nat. Sci. Phila., vii, p. 259, pl. xx, fig. 3, 1837.

Shell subrhomboid, subsolid, short, compressed, sharply flexed behind, with unusually high, sharp beaks; posterior end with a straight truncation above, ended by a sharp ridge on each valve; between this and the posterior ridge there is a shallow depression; postbasal point sharply triangulate; surface covered with rather close, sharp, concentric ridges; left valve with a slightly bifid anterior cardinal and a smaller posterior one; laterals scarcely developed; right valve with a bilobed posterior cardinal, a lamellar one in front of it, and two well-developed laterals. Color white.

Length, 20; height, 13; diameter, 5 mm.

Mayaguez, Porto Rico, two worn valves; Florida and Gulf coast.

Section EURYTELLINA Fischer, 1887.

Tellina alternata Say.

Tellina alternata Say, Journ. Acad. Nat. Sci. Phila., iv, p. 275, 1822; Am. Conch., pl. lxv, fig. 1.

Shell rather solid, compressed, nearly twice as long as high; beaks a little behind the center; ligament prominent; dorsal and ventral lines nearly parallel, anterior end almost evenly rounded; posterior end with a long, straight truncation above; posterior ridge somewhat double, the hinder sharply defined, ending at the post-base in a narrow, ill-defined triangulation; surface sculptured with rather wide, irregular, concentric ridges, often with faint indications of radial sculpture; left valve with two cardinals, the anterior small, the posterior larger and bifid, with two faint laterals; right valve with a strong bifid posterior cardinal and a narrow anterior one, a strong near anterior and a remote posterior lateral; muscle scars well marked. Color whitish to deep pink.

Length, 65; height, 35; diameter, 12 mm.

Mayaguez, Porto Rico, one young white valve.

Tellina georgiana Dall.

Tellina (*Eurytellina*) *georgiana* Dall, Proc. U. S. Nat. Mus., xxiii, No. 1210, p. 310, pl. ii, fig. 3, 1900.

Shell oblong, slightly rhomboid, compressed, thin, with a low posterior ridge which ends in a rounded point at posterior basal end of shell; surface more or less covered with wide, faint, flattened ridges, reddish or pinkish, sometimes with one or two faint white rays behind, shining, iridescent; left valve with a stronger anterior and a fainter posterior cardinal, with scarcely developed laterals; right valve with two cardinals, the hinder bifid, with a strong anterior and a faint posterior lateral.

Length, 17; height, 10; diameter, 4 mm.

Mayaguez; Aguadilla, Porto Rico.

Tellina vespuciana d'Orbigny.

Tellina vespuciana d'Orbigny, Moll. Cubana, II, p. 254, pl. XXVI, figs. 12-14, 1845.

Shell small, subrhomboid, rather solid, with a long, nearly straight posterior truncation; posterior ridge well developed, slightly duplex, ending below in a feeble biangulation; surface with rather fine, faint, concentric ridges, appearing smooth to the eye; shining, deep pinkish, or red, lighter at the beaks; left valve with a double posterior and a small anterior cardinal, and the laterals obsolete; right valve with a strong bifid posterior and a well-developed anterior cardinal, and two distinct laterals; the anterior high and compressed; interior deep red, brilliantly polished.

Length, 11; height, 6.5; diameter, 3 mm.

Mayaguez, Porto Rico, one fine, fresh specimen.

Tellina lineata Turton.

Tellina lineata Turton, Conch. Dict., p. 168, pl. IV, fig. 16, 1819; Sowerby, Conch. Icon., XVII, pl. XVIII, figs. 89 *a–c*.

Shell two-thirds as high as long, subsolid, subcompressed, with dorsal and basal lines parallel; posterior end with a well-defined ridge; above this is a sharp, short ridge, and the two hinder ridges inclose a small escutcheon in which is placed the ligament; base of shell feebly biangulate behind; surface covered with close, concentric ridges; valves flexed to the right; left valve with an anterior cardinal and a faint, compressed one behind it; anterior lateral feeble, posterior one strong; right valve with two cardinals, the hinder bifid, two strong laterals and a nymph. Color white, buff, or pink, the umbonal region of the pink variety generally deeper-colored.

Length, 30; height, 20; diameter, 7 mm.

Mayaguez, Porto Rico, one broken valve.

This species, which varies much in color, is better known by Lamarck's name, *T. brasiliana*.

Tellina martinicensis d'Orbigny.

Tellina martinicensis d'Orbigny, Moll. Cubana, II, p. 253, pl. XXVI, figs. 6, 8, 1845.

Shell small, short, decidedly rhomboid, rather solid, subinflated, with high, sharp beaks, with a nearly straight, oblique truncation behind, the anterior end rounded, a little prolonged above; there is a sharp posterior ridge in each valve at the edge of the truncation, and these ridges inclose a long, narrow escutcheon; from the beaks toward the center of the base the shell is much swollen; behind this it is flattened; the posterior basal point is somewhat biangulate; surface covered with rather widely spaced narrow ridges; white, not shining; left valve with two cardinals, the hinder higher and bifid, and two rather feebly developed laterals; right valve with two cardinals, the posterior widely bifid, and two laterals, all strongly developed.

Length, 10; height, 8; diameter, 4 mm.

San Juan Harbor; off Puerto Real, Porto Rico.

Subgenus ANGULUS Megerle, 1811.

Tellina sybaritica Dall.

Tellina sybaritica Dall, Bull. Mus. Comp. Zool., IX, p. 134, 1881; Blake, Report, I, pl. VI, fig. 11, 1886.

Shell small, somewhat elongated, subrhomboid, with a single rather sharply defined posterior ridge some distance below the edge, truncate above behind, a little rounded at base of truncation; beaks a little behind center; surface finely concentrically ridged; left valve with a feeble posterior and a strong bifid anterior cardinal and two moderate laterals; right valve with a strong posterior bifid cardinal and a smaller one in front, and two strong laterals. Color white or crimson.

Length, 6.5; height, 3.5; diameter, 2 mm.

Mayaguez; San Juan, Porto Rico.

Tellina consobrina d'Orbigny.

Tellina consobrina d'Orbigny, Moll. Cubana, II, p. 254, pl. XXVI, fig. 911, 1845.

Shell oblong, thin, the upper and lower edges parallel, with a rounded posterior ridge, above which the outline is a low curve from the beak to the base; surface with faint, fine, and somewhat irregular concentric lines; smooth to the eye and shining, semitransparent, whitish or pink tinted, with two broad, faint, red rays behind and sometimes two fainter ones in front; left valve with two cardinals, laterals almost wanting; right valve with a bifid posterior cardinal and a smaller one in front, a strong anterior lateral and a fainter posterior one.

Length, 15; height, 8; diameter, 4 mm.

Mayaguez, Porto Rico, numerous valves. Probably a variety of *T. versicolor* Cozzens, 1843.

Tellina vitrea d'Orbigny.

Tellina vitrea d'Orbigny, Moll. Cubana, II, p. 253, pl. XXVI, figs. 4, 5, 1845.

Shell subsolid, nearly twice as long as high, compressed, a little narrowed and rounded in front, truncate above behind; beaks somewhat back of the center; posterior ridge low, with a second faint ridge above it near the edge of the shell; the hinder part of the shell subbiangulate below; surface with low fine ribs; in some specimens these are quite distinct, in others they are scarcely more than growth lines; the whole is polished and shining. Color pink, often tinted with yellow, deep pink within; left valve with two divergent cardinals, that in front bifid, and two faint laterals; right valve with two cardinals, the hinder bifid, and two well-developed laterals; pallial line very deep.

Length, 33; height, 18; diameter, 6 mm.

Mayaguez, one right valve; Boqueron Bay, Porto Rico, one specimen.

Genus MACOMA Leach, 1819.

Valves with a marked posterior flexure, usually subtrigonal, and with a smooth or concentrically striate surface; hinge without lateral teeth; the siphons naked; the pallial sinus deep and usually coalescent with the pallial line below. Type, *M. tenera* Leach = *Tellina calcarea* Gmelin.

Macoma constricta Bruguière.

Solen constrictus Bruguière, Mém. Soc. d'hist. Nat. Paris, I, p. 126, 1799.
Tellina cayennensis Hanley, Thes. Conch., p. 312, pl. LXII, fig. 190, 1846.

Quebradillas, Porto Rico (Gundlach).

Macoma tenta Say, var. **souleyetiana** Recluz.

Tellina souleyetiana Recluz, Journ. de Conchyl., III, p. 253, pl. X, figs. 5, 5', 1852.

Shell thin, rather elongated, with dorsal and ventral lines parallel, rounded in front, truncate above behind, the posterior end somewhat drawn out, having two low posterior ridges ending in a truncated point a little above the base of the shell; the surface is nearly smooth and, though scarcely shining, it is faintly iridescent; around the outer part of the shell there is a fuscous epidermis; left valve with two cardinals, the anterior the larger; right valve with two cardinals, the posterior very small; pallial sinus rising high under the beaks, as in *M. tageliformis*. Color generally white.

Length, 18; height, 10; diameter, 6 mm. Mayaguez, Porto Rico, many shells.

Resembles a small *M. brevifrons* Say, but the posterior end is more strongly flexed than in tha species and considerably more drawn out. The hinder end is narrow and distinctly truncated, while in *M. brevifrons* it is wider and irregularly rounded. It is probably a southern variety of *M. tenta* Say.

Macoma pseudomera, n. sp. Plate 56, fig. 5.

Shell small, rather thin, solid, white, inequilateral, subequivalve; surface smooth except for fine, close, incremental lines and faint radial striations, but not polished; beaks not prominent; valves moderately convex, form as figured; interior white, polished, usually with well-defined scars, frequently dotted over the middle of the disk with a multitude of microscopic punctations; pallial sinus subcircular, almost wholly free from the pallial line and extending but little behind the middle of the shell; ligament short; hinge normal.

Length, 16; height, 12; diameter, 6 mm.

Mayaguez Harbor, Porto Rico, at station 6062, in 30 fathoms, sand, rather abundant; San Juan Harbor at station 6053, in 7½ fathoms, sand. Also at Bermuda and Jamaica (Vendryes).

This species bears a close external resemblance to *Angulus mera* Say, but has no lateral teeth and the form of the pallial sinus is entirely different. The periostracum is hardly noticeable, but is pale yellowish and papery, sometimes pubescent near the margin.

Subgenus PSAMMACOMA Dall, 1900.

Macoma brevifrons Say. Plate 55, figs. 3, 12, 13.

Tellina brevifrons Say, Am. Conch., VII, p. 227, pl. 64, fig. 7 (bad), 1834.

Shell oblong, subsolid, somewhat rhomboidal; the dorsal and ventral lines nearly parallel, subinflated; posterior slope truncated; the posterior end turned to the right, irregularly rounded and gaping; umbonal region smooth, whitish, somewhat shining and iridescent, the later growth covered with a cloth-like cinereous epidermis; left valve with a bifid cardinal under the beak and a small one before it; right valve with two cardinals, the hinder bifid; interior white, often salmon tinted or yellowish; pallial sinus bluntly rounded in front, high under the beaks.

Length, 35; height, 18; diameter, 10 mm.

Playa de Ponce; San Juan; Aguadilla, Porto Rico. It ranges from New Jersey south to Rio de Janeiro.

Macoma tageliformis Dall. Plate 55, figs. 10, 11, 15.

Macoma tageliformis Dall, Proc. U. S. Nat. Mus., XXIII, p. 300, 1900.

Shell oblong, solid, subrhomboid; dorsal and ventral lines nearly parallel; posterior end with a straight truncation above, which is bounded on each side by a well-defined ridge forming a sort of escutcheon behind; posterior basal part rounded; surface with close, irregular growth lines, whitish, rather dull; left valve with a bifid anterior cardinal and a compressed one behind it; right valve with two nearly equal cardinals, the hinder bifid; nymphs feeble with a ridge on their outer edges; pallial sinus rounded above under the beaks; interior white, never tinted.

Length, 46; height, 28; diameter, 13 mm.

Mayaguez, Porto Rico, one shell. Found also on the coast of Texas.

Differs from *M. brevifrons* in being heavier, higher in proportion, in having a straighter truncation, and in the pallial sinus, which is not carried up almost to a point under the beaks, as in that species. In *M. brevifrons* the posterior end is more attenuated.

Genus STRIGILLA Turton, 1822.

Shell suborbicular, the surface separated into two or three differently sculptured areas in which the ridges are divergent or convergent; posterior end not flexed; hinge as in *Tellina;* two laterals in each valve; pallial sinus angular, deep, coalescent below with the pallial line.

Strigilla carnaria Linnæus. Plate 58, fig. 3.

Tellina carnaria Linnæus, Syst. Nat., ed. X, p. 676, 1758.
Strigilla carnaria Turton, Dithyra Brit., p. 117, pl. VII, fig. 15, 1822.

Aguadilla; Quebradillas, Porto Rico (Gundlach).

It is possible that the specimens which Gundlach believed to be this are the next species. In *S. carnaria* the upper line of the pallial sinus connects the two adductor scars and is wholly coalescent below.

Strigilla rombergi Mörch. Plate 58, fig. 2.

Strigilla rombergi Mörch, Yoldi Cat., II, p. 15, 1853.

Very young specimens from San Juan are probably this species, in which the pallial sinus does not reach the adductor in front.

Strigilla flexuosa Say.

Tellina flexuosa Say, Journ. Acad. Nat. Sci. Phila., II, p. 303, 1822; Hanley, Thes. Conch., p. 261, pl. LVI, figs. 28, 29, 1846.

Shell small, short-oval, inflated, rather solid; beaks high, nearer the anterior end; the surface is covered with fine, low ribs which run obliquely and flexuously from the anterior end forward and downward to the low posterior ridge; behind the ridge they are zigzagged to the hinder end of the shell; left valve with two cardinals, the anterior erect, strong, slightly bifid, the posterior small and oblique, with two laterals; right valve with two cardinals, the posterior strong and somewhat bifid, and two strong laterals. Color whitish, cream or lemon yellow.

Length, 11; height, 10; diameter, 6.5 mm.

San Juan Harbor, Porto Rico, two young specimens.

Strigilla pisiformis Linnæus.

Tellina pisiformis Linnæus, Syst. Nat., ed. X, p. 677, 1758; Hanley, Thes. Conch, p. 261, pl. LVI, fig. 30, 1846.

Shell small, short-oval, somewhat inflated, rather solid; beaks high, nearer to the anterior end, with a distinct lunule in front of them; surface sculptured with fine, low, flexuous ridges running obliquely from the anterior end downward and backward to the low posterior ridge; at that line they are diverted sharply upward and slightly backward, and near edge of shell they are again turned sharply, passing downward and curving out to hinder edge of shell. The series of upturned ridges just back of the posterior ridge is finer than the others; hinder series rather coarse and somewhat corrugated; left valve with an erect, bifid cardinal and a small tooth behind it; right valve with two cardinals; two laterals in each valve. Color pinkish, the umbonal region and cavity of shell red.

Length, 9, height, 8; diameter, 5 mm.

Aguadilla; San Juan Harbor, Porto Rico.

Superfamily VENERACEA.

Family PETRICOLIDÆ.

Genus PETRICOLA Lamarck, 1801.

Shell rude, nestling or boring; hinge without lateral teeth, with three left cardinals, the middle one larger and bifid; and two right cardinals, the posterior bifid; ligament external, pallial sinus present, shells earthy, usually white, the nepionic young sometimes bright colored.

Petricola lapicida Gmelin.

Venus lapicida Gmelin, Syst, Nat., VI, p. 3269, 1792; Wood, Index Test., pl. 8, fig, 72, 1825.
Petricola costata Lamarck, Syst. An. sans Vert., p. 121, 1801.

San Juan Harbor, Porto Rico, in dead coral.

Family VENERIDÆ.

Subfamily VENERINÆ.

Genus VENUS Linnæus, 1758.

Shell thick, oval, generally inflated; valves ornamented with concentric ribs or lamellæ; lunule distinct; inner edge of the valves finely crenulated; hinge with three divergent cardinals in each valve, without laterals; pallial sinus deep, angular, ascending.

Venus rugatina Heilprin.

Venus rugatina Heilprin, Trans. Wagner Inst., I, p. 92, pl. XI, fig. 24, 1887.

Shell large, irregularly short—elliptical or suborbicular, solid, inflated; umbonal region full; beaks turned forward and outward; lunule very deep and wide; there is a decided projection of the front part of the shell just below it; left valve with a sharp ridge near its upper posterior edge; in the right valve the corresponding ridge is low, and the shell overlaps the left valve at the lower part of this ridge. Surface covered with peculiar lamellar ridges in two series; there is a set of larger sloping ridges on which are developed from four to eight smaller ridges, all lamellate and having the lamella reflexed backwards; sometimes every seventh or eighth ridge is slightly stronger than the rest; left valve having the hinder cardinal lamellar, the middle bifid, and the anterior compressed, with a faint anterior tubercle; right valve with the posterior and middle cardinals slightly bifid, the anterior compressed; beak cavities deep and wide; pallial sinus small, angular; border crenulations fine. Pale brownish with a few faint, broad rays.

Length, 90; height, 75; diameter, 60 mm.

Mayaguez, Porto Rico, a number of young, worn valves.

None of the recent specimens seen by the writers are more than a fourth grown. It is found in the Pliocene beds of the Caloosahatchie, and the dimensions given above are from a specimen from that locality.

? Venus rugosa Gmelin.

Venus rugosa Gmelin, Syst. Nat., p. 3276, 1792; Reeve, Conch. Icon., XI, pl. VII, fig. 23, 1863.

San Juan, Porto Rico (Gundlach).

This is perhaps the nearly allied *V. rugatina* instead of *rugosa*.

Venus brasiliana Gmelin.

Venus brasiliana Gmelin, Syst. Nat., p. 3289, 1792; Encycl. Méth., pl. 275, fig. 5.

San Juan, Porto Rico (Gundlach).

Venus cancellata Linnæus.

Venus cancellata Linnæus, Syst. Nat., ed. XII, p. 1130, 1767; Reeve, Conch. Icon., XI, 1863, pl. XIX, fig. 88.

Shell somewhat triangular, solid, inflated, with a high posterior ridge and a long, wide, posterior groove; beaks almost flattened in the adult shells, pointed forward toward the well-marked lunule; surface sculptured with from twenty to twenty-five strong, concentric, lamellar ridges and with numerous well-defined radiating ribs, those in front often clustered; the space behind the posterior ridge is smooth. Color, ashy, sometimes irregularly rayed with brown; rarely the brown predominates; crenulations of the inner border variable in size, somewhat clustered; pallial sinus very small, angular; interior white or often violet, with a light border.

Length, 38; height, 30; diameter, 25 mm.

Puerto Real; Mayaguez; San Juan; Boqueron Bay, Porto Rico; Vieques.

Venus granulata Gmelin.

Venus granulata Gmelin, Syst. Nat., p. 3277, 1792; Reeve, Conch. Icon., XIV, pl. XVI, fig. 62, 1863.

Shell rounded to subtriangular, inflated, solid, with a distinct lunule and a narrow posterior excavation; surface covered with radiating ribs which are crossed by concentric ridges, forming rather sharp nodules on the ribs. Color ashy, variously marked with brown, dotted, blotched, or sometimes in angular or chevron-shaped patterns, sometimes in irregular bands; rarely nearly the whole shell is brown. In the left valve the central cardinal is slightly bifid; in the right the two anterior ones are somewhat divided; interior variously marked with violet and white; border crenulations minute.

Length, 26; height, 23; diameter, 17 mm.

San Antonio Bridge, San Juan, Porto Rico, one specimen.

Venus latilirata Conrad.

Venus latilirata Conrad, Proc. Acad. Nat. Sci. Phila., I, p. 28, 1841.
Venus varicosa Sowerby, Thes. Conch, II, p. 723, pl. CLV, fig. 67, 1853.

Shell subtriangular, solid, inflated, with high umbonal region, though the beaks are rather compressed; lunule large; surface sculptured with nine or ten very strong, wide, concentric ridges; these are rounded and have a deep canal at their upper bases. Color dirty white or buff, with faint, various-sized pale-brown radiations; teeth entire; beak cavities deep; pallial sinus very small; border crenulations fine; interior white, with salmon or red tinting in the beak cavities.

Length, 33; height, 29; diameter, 22 mm.

Mayaguez, Porto Rico, dead young valves, possibly of this species.

Venus paphia Linnæus.

Venus paphia Linnæus, Syst. Nat., ed. XII, p. 1129, 1767; Reeve, Conch. Icon., XIV, pl. XIX, fig. 89, 1863.

Shell triangular, inflated, solid, with a well-developed posterior ridge in each valve, the area behind the ridges wide and shallow; lunule depressed so that the outline of that part of the shell inclosing it is incurved; surface covered with strong concentric ribs which are furrowed at the upper side and are nearly smooth over the anterior three-fourths of the shell; behind this and extending to the posterior area the ridges are lamellar. Color ashy or dirty white, variously marked with brown, the markings having a tendency to radiation, and they are often somewhat chevron-shaped. There are generally three more or less distinct dark radial bands; cardinals entire; pallial sinus very small.

Length, 45; height, 37; diameter, 26 mm.

Mayaguez, Porto Rico, one young specimen; Vieques, a number of beautiful examples.

This well-known species is near to the much rarer *V. latilirata*. The latter is smaller and has much heavier, wider ribs, which do not break into laminæ at their posterior ends.

Venus pygmæa Lamarck.

Venus pygmæa Lamarck, An. sans Vert., V, p. 585, 1818; Reeve, Conch. Icon., XIV, pl. XXVI, figs. 138 *a–c*, 1864.

Quebradillas, Porto Rico (Gundlach).

Subgenus ANOMALOCARDIA Schumacher, 1817.

Venus flexuosa Linnæus.

Venus flexuosa Linnæus, Syst. Nat., ed. XII, p. 1131, 1767.
Venus macrodon Reeve, Conch. Icon., XIV, pl. XXI, figs. 98 *b–d*, 1863.

Shell triangular, inflated, solid, with a high posterior ridge, which is almost pinched up in the earlier stages of growth, but which fades out near the base in the adult state; posterior end truncated, lunule large and shallow; surface more or less covered with strong, irregular, concentric ridges, which are often divaricate just in front of the posterior ridge, and having fine, radial sculpture above; the region toward the posterior base is always smooth. Color bluish or ashy white, variously marked with brownish or lead color; pallial sinus small and angular; crenulations on the inner border strong.

Length, 33; height, 28; diameter, 20 mm.

Mayaguez; Puerto Real, Porto Rico, worn valves.

Genus **MERETRIX** Lamarck, 1799.

Shell oval subtriangular, smooth or concentrically ridged, with a well-marked lunule; hinge with three cardinals in each valve, with two unequal anterior laterals in the right valve and one lateral in the anterior part of the left hinge; ligament external, prominent; pallial line sinuous.

Meretrix albida Gmelin.

Venus albida Gmelin, Syst. Nat., p. 3287, 1792.
Dione albida Reeve, Conch. Icon., XIV, pl. X, fig. 39, 1863.

Shell nearly elliptical, subinflated, subsolid; umbonal region rather prominent, the beaks turned inward and forward; lunule not impressed, but well marked; surface nearly smooth on the earlier growth, but becoming finely concentrically ridged on the later growth; anterior end a little narrowed and rounded, straight along the line of the lunule; posterior end broadly rounded. Color, externally, white, chalky, or somewhat polished; within, milky white; left valve with three radial cardinals, the two anterior united above so as to form an inverted V, the single lateral elevated and rounded or compressed; posterior cardinal of the right valve bifid, united above to the anterior cardinal; the two anterior laterals small; pallial sinus deep.

Length, 45; height, 35; diameter, 20 mm.

Mayaguez, Porto Rico, a number of young specimens and valves and one large valve; San Juan Harbor, young valves.

Meretrix aresta, n. sp. Plate 56, figs. 1, 7.

Shell large, solid, inflated, white or yellowish, very inequilateral, with prominent much incurved prosogyrate umbones, rounded in front, arcuate and almost rostrate behind, the base arcuate; lunule cordiform, hardly defined by an obsolete impressed line, but there is no defined escutcheon; ligament deeply immersed, very little of it visible externally; surface sculptured with fine, somewhat irregular concentric sulci in harmony with the incremental lines, but coarser and more excavated, with often a few narrow undulations near basal margin; umbonal region somewhat smoother and often appears polished by attrition; interior dull white, not polished, with a short anteriorly rounded subtriangular pallial sinus; hinge normal, with a subconic left anterior lateral fitting into a pit in the right valve.

Length, 51; height, 50; diameter, 28 mm.; a larger valve is 58 mm. long.

Mayaguez Harbor, Porto Rico, at stations 6061 and 6062, in 12 to 30 fathoms, abundant; a single young pair off Puerto Real at station 6074.

Nearest to *M. albida*, but with a rougher surface, a different outline, and attaining a larger size.

Meretrix hebræa Lamarck.

Cytherea hebræa Lamarck, An. sans Vert., v, p. 568, 1818.
Circe hebræa Reeve, Conch. Icon., XIV, pl. VIII, fig. 34, 1863.

San Juan, Porto Rico (Gundlach).

Meretrix maculata Linnæus.

Venus maculata Linnæus, Syst. Nat., ed. X, p. 686, 1758.
Dione maculata Reeve, Conch. Icon., XV, pl. III, fig. 11, 1863.

Quebradillas, Porto Rico (Gundlach).

Subgenus DIONE Gray, 1847.

Meretrix circinata Born.

Venus circinata Born, Test. Mus. Vind., p. 61, pl. IV, fig. 8, 1780.

Mayaguez, Porto Rico (Gundlach).

Meretrix dione Linnæus. Plate 56, figs. 3, 10.

Venus dione Linnæus, Syst. Nat., ed. X, p. 684, 1758.
Dione veneris Reeve, Conch. Icon., XV, pl. VI, fig. 24, 1863.

Shell triangular-ovate, inflated, subsolid, with high, full beaks, which are curved forward over a well-impressed lunule; ligament lodged within a decided escutcheon; surface covered with strong, reflected, concentric ribs, which are especially high in front and much reduced on the posterior slope; on a posterior radial ridge there is a row of long spines which project outward and backward, and behind these, on a second fainter ridge, there is another row of smaller spines; left valve with three cardinals, the central one heavy and somewhat bifid, with a short, erect anterior lateral; right valve with three cardinals, the posterior one bifid, with two faint anterior laterals separated by a deep pit; pallial sinus deep. Color violet and whitish, the posterior end often quite dark.

Length, 50; height, 40; diameter, 28 mm.

Fajardo, Porto Rico, two fine specimens.

The spines are often somewhat curved; sometimes they are much reduced, so that they are in reality merely elevated scales.

Subgenus TRANSENNELLA Dall, 1883.

Internal margins tangentially sulcate.

Meretrix cubaniana d'Orbigny.

Venus cubaniana d'Orbigny, Moll. Cubana, II, pl. XXVI, figs. 44–46, 1845.

Shell rather small, triangular-ovate, solid, rather compressed, inequilateral, with high beaks, slightly turned forward over a large, well-defined lunule; surface covered with low, irregular, concentric ridges; left valve with three cardinals, the central tooth strong, and a high, compressed anterior lateral; right valve having the two anterior cardinals separated by a narrow fissure and two small anterior laterals with a deep pit between them; pallial sinus deep. Color white, generally with a few irregular brown markings.

Length, 8; height, 6; diameter, 4 mm.

Mayaguez, Porto Rico, a few worn valves.

The internal margins of the valves are sharply grooved, but not in harmony with the lines of growth, which is the characteristic of this subgenus, of which the species are all small shells.

Meretrix culebrana, n. sp. Plate 55, fig. 5.

Shell small, solid, subtrigonal, with elevated beaks, nearly equilateral, moderately convex; periostracum rather thick, yellowish brown, paler on the umbones and posterior dorsal area; surface obsoletely minutely concentrically undulated, with a rather large, ovate-cordate, somewhat depressed lunule defined by a well-impressed line, but no perceptible escutcheon; form as figured; interior white; hinge strong, normal, a prominent, anterior lateral in each valve; pallial sinus subtriangular, rounded in front; marginal grooving well marked.

Length, 7; height, 5.7; diameter, 3.8 mm.

At station 6087, in 14 to 18 fathoms, coral sand, off Culebra Island, Porto Rico.

A very pretty and characteristic species of this peculiar group, which can not be confounded with either of the other described species.

Genus DOSINIA Scopoli, 1777.

Shell suborbicular, compressed or slightly inflated, concentrically sculptured, with prominent beaks and a well-defined lunule; hinge with three cardinal teeth in each valve; left valve with an anterior lateral close to the front cardinal; right valve with two vestiges of anterior laterals; pallial sinus deep; border of the shell without crenulations.

Dosinia elegans Conrad.

Artemis elegans Conrad, Proc. Acad. Nat. Sci. Phila., VI, p. 320, 1853.
Artemis concentrica Reeve, Conch. Icon., VI, pl. II, fig. 8, 1850; not of Born, 1780.

Shell suborbicular, rather solid, subtruncated posteriorly and almost angular at the posterior end of the ligament; lunule small and distinct; ligament nearly immersed; beaks high and rather sharp, turned forward; surface covered with rather strong, close, concentric ridges and showing faint traces of radial sculpture on earlier growth; left valve having central cardinal wide and flattened, the anterior lateral small and tubercular; right valve with posterior cardinal bifid; beak cavities deep, compressed; muscle scars elongated, smooth; pallial sinus deep, triangular. Color whitish; epidermis straw-colored.

Length, 75; height, 68; diameter, 30 mm.

Playa de Ponce, Porto Rico, three dead shells.

Genus MYSIA Leach, 1818.

Shell suborbicular, concentrically striate, with a faint lunule and high beaks; hinge with two to three divergent cardinals in the right valve and three in the left; laterals wanting; pallial sinus large, subvertical.

Mysia tenuis Recluz.

Dosinia (*Artemis*) *tenuis* Recluz., Journ. de Conchyl., III, p. 250, pl. x, fig. 1, 1853.

Shell nearly orbicular, thin to subsolid, subinflated; beaks pointed and turned slightly forward over a faint lunule; ligament nearly immersed; surface finely and irregularly concentrically striate, whitish; left valve with three diverging cardinals, the anterior with a deep pit in front of it, sometimes slightly bifid; right valve with three divergent cardinals, the posterior bifid; hinge plate wide and flattened behind when the shell is adult; beak cavities deep; anterior muscle scars elongated; posterior scars oval; pallial sinus triangular.

Length, 42; height, 41; diameter, 21 mm.

Playa de Ponce, Porto Rico, one dead, badly discolored specimen; Mayaguez, one left valve.

Subfamily CIRCINÆ.

Genus CIRCE Schumacher, 1817.

Shell subtriangular or subcircular, compressed or slightly inflated, with concentric and sometimes radial sculpture; beaks pointed; lunule lanceolate; ligament immersed; hinge teeth like those of *Meretrix;* pallial line entire or showing a slight indication of a sinus.

Subgenus Gouldia C. B. Adams, 1847.

Shell small, subinflated, the surface wholly or distally reticulate.

Circe cerina C. B. Adams.

Thetis cerina C. B. Adams, Proc. Bost. Soc. Nat. Hist., Jan., 1845, p. 9.

Gouldia cerina C. B. Adams, Cat. Coll., p. 29, 1847; Dall, Bull. Mus. Comp. Zool., IX, p. 130, 1881; Dall, Blake Report, I, p. 263, pl. VII, figs. 4*a*, 4*b*, 1886.

Shell small, rounded-triangular, scarcely inflated, with high beaks which scarcely turn forward; lunule well defined but not impressed; ligament mostly immersed; surface covered with faint, concentric ridges and indistinct distal radial ribs, leaving the surface delicately decussated; cardinal teeth, three in each valve, rather feeble; left valve with an anterior lateral which fits into a socket in the right valve which is placed between two faint teeth. Color whitish or yellowish, usually marked with brown on the dorsal region, and often with irregular patches on the disk.

Length, 11; height, 9.5; diameter, 4.6 mm.

Culebra Island, one shell, at station 6087.

Circe insularis, n. sp. Plate 55, fig. 2.

Shell small, yellowish white, quite inequilateral, moderately convex, with a prominent, rather anterior, beak; sculpture of small, close-set, subequal, concentric undulations, with narrower interspaces and less pronounced on the umbones, crossed by fine radial striæ, which are stronger toward the ends of the valves, where the interspaces sometimes become threadlike; lunule small, sharply defined, rather long and narrow; escutcheon absent; interior white, the margin in many specimens with a fine sulcus, parallel to it around the shell; hinge normal; pallial line entire, but slightly truncate behind.

Length, 5.5; height, 5; diameter, 3 mm.

San Juan and Mayaguez harbors, Porto Rico; in the latter abundantly at station 6061, in 30 fathoms, coral sand, but no living specimens were taken.

Well distinguished from the other American species by its form and size.

Superfamily CARDIACEA.

Family CARDIIDÆ.

Genus CARDIUM Linnæus, 1758.

Shell ventricose, closed or gaping posteriorly; beaks prominent, subcentral; surface radiately ribbed; posterior slope sculptured differently from the front and sides; margins toothed; there are two interlocking cardinals and an anterior and posterior lateral in each valve; pallial line simple.

Subgenus Trachycardium Mörch, 1853.

Cardium muricatum Linnæus.

Cardium muricatum Linnæus, Syst. Nat., ed. x, p. 680, 1758; Reeve, Conch. Icon., II, pl. VI, fig. 33, 1844.

Shell subsolid, slightly oblique, scarcely gaping behind, having from thirty to forty ribs, each of which bears a row of solid, oblique scales; about eleven of the anterior ribs have these scales sloping toward the anterior base; on the fourteenth rib there are two rows of scales, and on the ribs behind this they point toward the posterior base; the rest of the surface of the ribs and the grooves between them are nearly smooth; within the central ribs are distinctly shown; serrations around the edges of the shell strong. Color whitish, buff, tawny, or brownish, sometimes variegated; within, whitish or yellowish, sometimes streaked or marked with brownish purple.

Length, 35; height, 40; diameter, 28 mm.

San Antonio Bridge; San Juan; Mayaguez, Porto Rico.

Cardium leucostoma Born.

Cardium leucostomum Born, Test. Mus. Cæs. Vind., p. 46, pl. III, fig. 6, 1780.

San Juan Harbor, Porto Rico, one young shell.

This species was regarded by Wood, with much probability, as being the original *C. magnum* of Linnæus (not of Born), but there is no way of proving this and so the name is best left as it is. The species in a general way resembles *C. isocardia*, but wants the spinose sculpture, has the sides of the ribs crenulate, and is more compressed. It is found in collections labeled *C. marmoreum* Lamarck and *C. elongatum* Wood, or *C. subelongatum* Sowerby, all later names than that of Born.

Cardium isocardia (Linnæus) Reeve.

Cardium isocardia Linnæus (ex parte), Syst. Nat., ed. X, p. 679, 1758; Reeve, Conch. Icon., II, Mon. *Cardium*, pl. XVII, fig. 84, 1845.

Off Boca Prieta, Porto Rico, in 8 fathoms, sand, at station 6075, living.

The form common in Florida has 27 to 30 ribs, and the spinose decoration is less dense than that in the typical West Indian form, which has 30 to 35 ribs. In the former the periostracum is more dense and dull colored, and the channels between the ribs, owing to the less-developed sculpture, appear wider. This variety was named *C. egmontianum* by Shuttleworth, and the name seems worthy of retention in a varietal sense. The typical *C. isocardia* is brighter colored and has more yellow inside than the variety. *C. eburniferum* Guppy appears identical with the typical *C. isocardia*.

Subgenus FRAGUM Bolten, 1798.

Section **TRIGONIOCARDIA** Dall, 1900.

Cardium antillarum d'Orbigny.

Cardium antillarum d'Orbigny, Moll. Cubana, II, p. 309, pl. XXVII, figs. 53–55, 1845.
Cardium ceramidum Dall, Bull. Mus. Comp. Zool., Cambridge, XII, 1886, p. 269, pl. IV, fig. 6.

Shell small, quite inequilateral, solid, moderately inflated, with from eighteen to twenty ribs, the last six or seven on the posterior area crossed by fine, irregular, sharp, concentric threads. Of these the last four or five are nodulous; the next two are without nodules; the central ribs are very strong, gradually becoming smaller toward the anterior end; they all have a row of nodules or heavy scales and the spaces between them are concentrically grooved; sometimes the ribs, if worn, are nearly destitute of scales, and in other cases they are all more or less scaly: within, the ribs show faintly; beak cavities deep; hinge and teeth strong. Color white or yellowish throughout.

Length, 10; height, 9.5; diameter, 7 mm.

Mayaguez Harbor, Porto Rico, many dead valves at stations 6058, 6061, 6062; San Juan Harbor, one valve.

Section **FRAGUM** s. s.

Cardium medium Linnæus.

Cardium medium Linnæus, Syst. Nat., ed. X, p. 678, 1758; Reeve, Conch. Icon., II, pl. VI, fig. 30, 1844.

Shell inequilateral, subrhomboid, solid, with a high, rounded posterior ridge, behind which it is subtruncate, with thirty-five or thirty-six moderately strong, nearly smooth ribs; about ten of these, which are on the posterior slope, are rounded and have rather deep grooves between; those of the rest of the shell overhang the deep, rounded grooves between them; teeth strong. Color whitish or buff, variously painted with brown or brownish purple.

Length, 85; height, 37; diameter, 30 mm.

Mayaguez Harbor, Porto Rico, at station 6062; Vieques.

Subgenus Papyridea Swainson.

Cardium spinosum Meuschen.

Cardia spinosum Meuschen, Mus. Gevers., p. 442, 1787.
Solen bullatum Chemnitz, Conch. Cab., VI, p. 65, figs. 49, 50, 1782; not of Linnæus.
Cardium bullatum Reeve, Conch. Icon., II, pl. II, fig. 8, 1844.

San Juan, Porto Rico (Gundlach).

Cardium semisulcatum Gray.

Cardium semisulcatum Gray, Ann. Phil., IX, p. 137, 1825.
Cardium petitianum d'Orbigny, Moll. Cubana, II, p. 309, pl. XXVII, figs. 50–52, 1845.

Shell small, elliptical, thin, very inequilateral, moderately inflated, with numerous low ribs, and with more or less perfectly developed smaller ribs between the larger ones, the margin at the posterior end sharply toothed; surface covered with fine concentric growth lines, which are stronger on the anterior part of the shell; interior showing the sculpture; hinge teeth compressed. Color whitish or yellowish, with faint brown blotches and spots.

Length, 10; height, 6.5; diameter, 5 mm.

San Juan, Porto Rico, one valve; off Boca Prieta, Porto Rico, one specimen on *Spondylus*.

Subgenus Lævicardium Swainson, 1840.

Cardium serratum Linnæus.

Cardium serratum Linnæus, Syst. Nat., ed. X, p. 680, 1758.
Cardium serratum Reeve, Conch. Icon., II, pl. I, fig. 1, 1844.

Shell subsolid, suboval or subquadrate, the posterior edge being less curved than the anterior; the low, rounded, posterior ridge being slightly produced at the base of the shell; surface nearly smooth, shining and polished, with only faint vestiges of ribs, which appear on the border of the shell which scarcely gapes and has delicate serrations within; laterals high and strong; cardinals small; interior of the shell polished; in a fresh state the surface is usually covered with a thin, brownish epidermis; the shell is beautifully polished, whitish, straw-colored, lemon-yellow, purplish or reddish, and it is slightly clouded with brown near the beaks; within it has much the same range of colors, and it is one of the most delicate and lovely shells of the Antilles.

Length, 37; height, 45; diameter, 30 mm.

Vieques, a number of very fine specimens; Mayaguez, two young valves; Culebra, several young shells.

Cardium (serratum var.?) sybariticum Dall. Plate 58, fig. 11.

Cardium serratum var. *sybariticum* Dall, Bull. Mus. Comp. Zool., Cambridge, XII, p. 271, 1886.

Shell much smaller and more delicate than the type, more compressed, pale or faintly flecked with pink or purple; beaks often deep pink.

Length, 11; height, 14; diameter, 7 mm.

Mayaguez Harbor, Porto Rico, a number of dead valves.

Cardium serratum var. **lævigatum** Lamarck.

Cardium lævigatum Lamarck, An. sans Vert., pt. I, p. 11, 1819; not of Linnæus, 1758, nor of Born, 1780.

Shell rather large, subsolid, moderately inflated, subquadrate, usually, though not always, faintly ribbed; ribs numerous when developed, strongest around the outer part of the shell; there is an area at the anterior and posterior parts of the shell which is generally smoother than the rest of it, which is outlined by a shallow groove, forming a sort of lunule and escutcheon; laterals rather strong, especially the anterior ones; edges of the shell serrated within.

Color generally whitish, cream or pale buff, with a few faint subconcentric cloudings of brown.

Length, 50; height, 63; diameter, 40 mm.

One dead shell having the above measurements was taken at Playa de Ponce, Porto Rico.

Generally larger, more quadrate, duller colored, and more painted with brownish, nebulous bands than typical *serratum*, yet there are intermediate specimens which can be assigned to one form about as well as to the other. This form is one of the characteristic species of west Florida.

Cardium serratum var. **multilineatum**, n. var.

Cardium lineatum Krebs, W. I. Marine Sh., p. 115, 1864; not of Gmelin.

Smaller, more nearly round than the type. The smoother anterior and posterior areas are distinctly marked out and are tawny or buff colored; the rest of the shell is dirty straw colored, and the narrow spaces between the scarcely developed ribs are pale brown; the beaks are purple, clouded. The interior is much the color of the yolk of an egg, with purple cloudings at the cavities of the beaks.

Length, 40; height, 45; diameter, 32 mm.

Mayaguez Harbor, Porto Rico, stations 6058 and 6061.

Genus PROTOCARDIA Beyrich, 1845.

Sculpture radial anteriorly; posterior area with reticulate or spinose sculpture; shells thin and usually small; foot carinate.

Protocardia peramabilis Dall.

Cardium peramabile Dall, Bull. Mus. Comp. Zool., Cambridge, IX, p. 132, 1881; Bull. Mus. Comp. Zool., Cambridge, XII, p. 269, pl. IV, fig. 7, 1886.

Shell small, slightly inequilateral, rather thin and fragile, inflated; posterior area sculptured with a great number of fine, radiating, nearly smooth ribs, the spaces between them being slightly pitted, the whole being covered with a fine epidermis, which is scaly on the ribs; the anterior three-fifths of the shell is sculptured with equally fine, radiating ribs, and these are crossed by very numerous somewhat fainter, concentric ridges, leaving the surface everywhere minutely beaded; borders of the shell delicately and sharply serrate, not gaping; within the shell the outside patterns of sculpture may be plainly seen. Color whitish.

Length, 10; height, 11; diameter 9 mm.

Mayaguez Harbor, Porto Rico, two shells; Aguadilla, one worn valve.

The foot is keeled below but not serrate.

Protocardia tincta Dall. Plate 58, fig. 4.

Cardium peramabile var. *tinctum* Dall, Bull. Mus. Comp. Zool., Cambridge, XII, p. 270, 1886.

Shell small, fragile, nearly equilateral, considerably inflated; posterior area sculptured with minute, radiating ribs; every second, third, fourth, or fifth one bears a row of sharp, elevated spines or scales; the spaces between these ribs are crossed by delicate scales, making them pitted; the remainder of the shell is sculptured with very finely beaded ribs, as in *P. peramabilis;* borders of the shell finely and sharply serrate, not gaping; outside sculpture showing faintly within; anterior laterals showing as long arched ridges within, entering far within the cavity of the beaks. Color whitish, beautifully tinted and clouded with pink or red.

Length, 13; height, 12; diameter, 9 mm.

Mayaguez Harbor, Porto Rico, in 25 to 30 fathoms. Quite a number of valves were taken.

This beautiful form is certainly distinct from *P. peramabilis.* It is not so high in proportion to its width, is a little less inflated, the line between the two areas of sculpture is not so distinctly marked out, and when perfect it has the scaly spines on the posterior area finely developed. The anterior lateral teeth are different from those of *P. peramabilis.*

Family THYASIRIDÆ.

Genus THYASIRA Leach, 1818.

Shell thin to subsolid, subglobular, earthy; beaks turned forward; posterior side furrowed; lunule absent; ligament placed in a groove in the hinge line, partly external; hinge edentulous; muscular impressions superficial, elongated; pallial line simple; borders of the shell closed, simple.

It is *Cryptodon* and *Axinus* of authors.

Thyasira trisinuata d'Orbigny.

Lucina trisinuata d'Orbigny, Moll. Cubana, II, p. 300, pl. XXVII, figs. 46–49, 1846.

Cryptodon obesus Verrill, Am. Journ. Sci., III, p, 287, pl. 7, fig. 2, 1872; Trans. Conn. Acad. Sci., III, p. 11, pl. 1, fig. 11 (not of Sars).

Shell rather small, scarcely subsolid, inflated, higher than long, somewhat produced at the middle of the base; beaks high and rather full, turned forward over a feebly developed lunule; posterior slope with two deep, distinct, radial grooves; surface finely, concentrically striated; ligament lodged in a groove in the edentulous hinge; back cavities rather deep. Color white throughout.

Length, 12; height, 14; diameter, 10 mm.

Mayaguez, Porto Rico, several immature, worn valves, which appear to be of this species.

Thyasira conia n. sp.

Shell small, thin, rather compressed, inequilateral, the anterior end longer, somewhat impressed above, the posterior high and arcuate above, abruptly truncate in front, base rounded; shell white, with a light grayish periostracum and some specimens a little rusty; posterior dorsal fold narrow and pronounced, but not very deep; surface covered with a fine dustlike granulation; the young proportionately more elongated, interior white, dull, with a polished margin outside the more or less broken and irregular pallial line; ligament elongated, brown, almost internal, set in a deep sulcus; resilium blackish, short, subumbonal, set on an obscure prominence on the hinge line in each valve, which, if the resilium were lost, would resemble obscure teeth; soft parts typical, with arborescent visceral appendages.

Length, 6; height, 6; diameter, 3 mm.

Off the entrance to San Juan Harbor, Porto Rico, in 310 fathoms, sandy mud, at station 6052.

A well-marked species, easily discriminated by its form and surface from any other among the American species. See Dall, Synopsis of the Lucinacea, pl. XLII, fig. 2, 1901.

Family LUCINIDÆ.

Genus CODAKIA Scopoli, 1777.

Codakia orbicularis Linnæus.

Venus orbicularis Linnæus, Syst. Nat., ed. X, p. 688, 1758.
Lucina tigerina Reeve, Conch. Icon., VI, pl. I, fig. 3, 1850, not of Linnæus, 1758.

Shell large, suborbicular, rather solid, lenticular, with rather low but sharp beaks, which are turned forward over a small lunule, with a shallow, wide, radial posterior furrow and numerous radiating ribs or narrow, radiating furrows which cut the surface into ridges of different widths; the growth lines are elevated into fine, concentric ridges which leave the surface somewhat cancellated; ligament deeply inset; left valve with two radial cardinals and two low anterior laterals separated by a deep pit; right valve with two cardinals and a single anterior lateral; beak cavities rather deep, compressed; anterior muscle scars long, oblique; posterior scars oval; pallial line deep, crenated, disk rather rough, with numerous small pits. Color whitish or yellowish, often tinted with purple on the dorsal border, within white or yellow, often rich purple on the border, especially above.

Length, 80; height, 70; diameter, 30 mm.

Puerto Real, San Geronimo, Hucares, Mayaguez, Porto Rico (Gundlach); West Indian region generally.

A fine species very abundant on sandy bottom in shallow water throughout the West Indian region and in the Florida Keys. It is close to the East Indian *C. tigerina*, but is not so strongly cancellated or so nearly orbicular as is that species.

Subgenus JAGONIA Recluz, 1869.

Codakia orbiculata Montagu.

Venus orbiculata Montagu, Test. Brit. Suppl., p. 42, 1808.
Lucina pecten Lamarck, An. sans Vert. V, p. 543, 1818; Reeve, Conch. Icon., VI, pl. X, fig. 38, 1850.

Shell suborbicular, inequilateral, compressed, rather solid, with sharp beaks, which are turned slightly forward over a large, indistinct lunule; ligament partly immersed, short; surface covered with numerous radiating ribs which are crossed by a large number of concentric finer ridges; these ridges sometimes form elevated scales where they cross the ribs, especially on the anterior and posterior portions of the shell; left valve with two radial cardinals, the anterior the larger, with two anterior and two posterior laterals; right valve with two cardinals, the posterior slightly bifid, with one anterior and one posterior lateral; beak cavities deep, compressed; anterior scars long, oblique; posterior scars oval; cavity of the shell rough, sometimes showing the ribbing of the shell; border crenate. Color whitish or yellowish.

Length, 13; height, 12; diameter, 5.5 mm.

Ensenada Honda, Culebra, one specimen.

The beaks of this species are placed considerably behind the center of the shell, which is compressed and quite rough.

Codakia portoricana Dall.

Codakia (*Jagonia*) *portoricana* Dall, Synopsis of the Lucinacea, p. 822, pl. XXXIX, fig. 6, 1901.

San Juan Harbor, and the harbor of Mayaguez, Porto Rico.

This inconspicuous little species appears to be rare and comes nearest to *Jagonia costata* d'Orbigny, than which it is more finely and evenly sculptured, besides being a more tumid and much smaller shell, measuring not over 8 mm. in length.

Codakia costata d'Orbigny.

Lucina costata d'Orbigny, Moll. Cubana, II, p. 296, pl. XXVII, figs. 40–42, 1846.

Shell suborbicular, somewhat inflated, rather solid, with moderately high beaks placed just behind the middle of the shell, and turned forward over a small, elongated lunule; surface covered with fascisulate, radiating ridges, which are often alternately larger and smaller; these are crossed by finer, concentric threads, which cause the shell to be rough and finely cancellated; left valve with two cardinals, the hinder smaller, and two anterior and two posterior laterals; right valve with one cardinal, a faint posterior ridge that extends from the beak to form a lateral and one anterior lateral; beak cavities deep; anterior scars long, somewhat oblique; posterior scars semicircular; pallial line deep, somewhat crenated; interior rough; border distinctly serrate. Whitish or pale lemon color.

Length, 9; height, 8; diameter, 5 mm.

Arroyo, Hucares, Porto Rico, one valve from each locality.

The beaks are nearer the center than in *C. pectinella*, the shell is solider, and the sculpture is fascisulated. It is the *Lucina antillarum* of Reeve.

Codakia pectinella C. B. Adams. Plate 58, fig. 9.

Lucina pectinella C. B. Adams, Contr. to Conch., p. 246, 1852.

Shell small, short elliptical, inflated, subsolid, with full beaks placed somewhat behind the middle of the shell and turned forward over a small lunule, with numerous, radiating, wider and narrower ribs, which are crossed by a great number of concentric, raised threads; the ribs are almost wanting at the anterior and posterior ends; left valve with two cardinals and two anterior and two posterior laterals; right valve with one cardinal, one anterior and two posterior laterals; anterior muscle scars somewhat elongated and oblique; posterior scar oval; interior of the shell roughened; border crenate. Color white or yellowish.

Length, 7.5; height, 8; diameter, 4 mm.

Mayaguez, one adult valve and a number of small ones; San Juan Harbor, one valve. A single alcoholic specimen was obtained at Mayaguez.

The species is now figured for the first time from a specimen named by Professor Adams.

Genus LUCINA (Bruguière 1792) Lamarck 1799.

Shell suborbicular, almost equilateral, rather thin, concentrically striate; ligament in a groove; lunule short; teeth all obsolete or rudimentary, often wanting.

Lucina chrysostoma Mörch.

Loripes chrysostoma Mörch, Yoldi Cat., II, p. 32, 1853; Chemnitz, Conch. Cab., VII, figs. 427–429.

San Juan, Porto Rico (Gundlach).

Mörch cites this name as of Meuschen, but the Museum Geversianum uses a peculiar nomenclature not Linnean. It is the *Anodontia alba* of Link. The shell is recognizable by its large size and mellow orange suffusion, from which the early conchologists came to call it "The apricot."

Lucina phenax, n. sp.

Shell small, suborbicular, inflated, thin, with the hinge teeth obsolete. Color white, with a grayish papery periostracum chiefly in evidence near the margins; beaks polished, prosogyrate, with a deeply impressed, rather long and narrow lunule in front of them, especially in the right valve; disk sculptured by rather distant, evenly spaced, low, concentric elevated lines, which become more or less lamellose near the hinge margin, and more crowded toward the base; interior of shell white, not punctate, hinge margin narrow with no traces of laterals, and only a trace of an obsolete cardinal tooth; margins thin, smooth.

Length, 9; height, 8; diameter, 5.5 mm.

Station 6062, Mayaguez Harbor, Porto Rico, in 30 fathoms, sand; also in San Juan Harbor, at station 6054, in 5 fathoms.

This shell has a deceptive likeness externally to a young *Phacoides pensylvanicus*, but differs from it in its edentulous hinge and thinner valves. It is figured by Dall in the Synopsis of the Lucinacea, pl. XL, fig. 3.

Genus MYRTÆA Turton, 1822.

Myrtæa pristiphora, n. sp. Plate 55, figs. 4, 6.

Shell small, solid, white, moderately convex, with small, conspicuous beaks; surface of the beaks nearly smooth, the remainder of the disk sculptured with fine, concentric, close set, rather uniform lamellæ, which, toward the hinge line at each end of the shell, become more elevated and sparser; at hinge line these lamellæ in perfect specimens are produced into little triangular projections, which form a saw-like series along the hinge line; lunule lanceolate, very small and narrow; interior of disk punctate; lateral and cardinal teeth moderately developed, margins finely radially striate or smooth.

Length, 7; height, 7.5; diameter, 4 mm.

Mayaguez Harbor, Porto Rico, at station 6062, in 30 fathoms, sand; also in San Juan Harbor in 45 fathoms, at station 123.

Genus PHACOIDES Blainville, 1825.

Shell suborbicular, white, solid, concentrically lamellated or sculptured, and often having radial or oblique sculpture; beaks compressed; margins smooth or crenulate; hinge teeth, 2.2; laterals, 1.1 and 2.2, or obsolete; muscular impressions rugose, the anterior elongated within the pallial line; umbonal area with an oblique furrow.

Phacoides pectinatus Gmelin.

Tellina pectinata Gmelin, Syst. Nat., VI, p. 3236, No. 41, 1792.
Lucina jamaicensis Lamarck, An. sans Vert., V, p. 539, 1818; Reeve, Conch. Icon., VI, pl. II, figs. 7, *a*, *b*, 1850.

Shell suborbicular, scarcely inflated, rather solid, sculptured throughout with concentric ridges, which are sometimes close and irregular and at other times widely spaced and lamellar; beaks rather low, turned forward over a small lunule; ligament partly immersed in the hinge plate; there is a wide radiating furrow beginning at the lunule and ending in front in a decided sinus at the edge of the shell, and there is a radiating posterior depression just behind the posterior ridge; left valve with two small oblique cardinals, which are sometimes faint or wanting, with two anterior laterals, the lower the larger, and two very small remote posterior laterals; right valve with one oblique, small cardinal, which may be feeble or wanting, with one anterior and one posterior lateral; cavity of the shell often radially rugose and slightly pustulose; anterior muscle scars long, narrow, and rather smooth; posterior scars oval. Color dirty white or pale salmon, within and without.

Length, 55; height, 50; diameter, 30 mm.

San Juan market, San Antonio Bridge, San Juan, Quebradillas, Porto Rico (Gundlach); West Indies and Florida; abundant in shallow bays, on sandy muddy bottom.

Subgenus HERE Gabb, 1866.

Phacoides pensylvanicus Linnæus.

Venus pensylvanica Linnæus, Syst. Nat., ed. X, p. 688, 1758.
Lucina pennsylvanica Reeve, Conch. Icon., VI, pl. VI, fig. 29, 1850.

Shell suborbicular, inflated, solid, with rather high, sharp beaks turned forward over a large lunule, with a distinct radial posterior furrow, which ends in a sinus above the base; epidermis raised into numerous concentric, elevated laminæ, the outer edges of the laminæ developed into wide, reflexed fimbriations; ligament mostly imbedded; left valve with two elevated cardinals and one anterior and two posterior laterals; right valve with a bifid cardinal, a high anterior, and double posterior lateral; anterior and posterior scars elongated; cavity of the shell rough, sometimes pitted, having a diagonal, impressed line running from near the base of the ligament toward the anterior base. Color white throughout, the epidermis becoming brownish in old shells.

Length, 54; height, 53; diameter, 40 mm. Mayaguez, Porto Rico, a number of young valves.

The outline from the beaks to the anterior point of the shell is nearly straight or slightly incurved as a result of the deeply impressed lunule.

Section CAVILUCINA Fischer, 1887.

Phacoides trisulcatus Conrad, var. **blandus** Dall. Plate 58, fig. 13.

Lucina trisulcata Conrad, Am. Journ. Sci., n. s., I, p. 404, 1846.

Shell obliquely subtriangular, higher than long, with the beaks placed behind the center, considerably elevated, and arched forward over a decidedly deep lunule; ligament short, nearly buried; there is a shallow radial furrow on the posterior slope; surface finely concentrically ridged, also with three or four deeper sulci generally having traces of radiating grooves which do not cut to the bottom of the concentric ridges; left valve with two cardinals, two anterior and two posterior laterals; right valve with two cardinals, one anterior and one posterior lateral; beak cavities moderately deep. Color white, yellowish, or salmon.

Length, 12; height, 13; diameter, 8 mm. San Juan Harbor, Porto Rico.

The deep sulci, usually three in number, seem to indicate resting stages. The typical *trisulcatus* is a Miocene fossil.

Subgenus LUCINISCA Dall, 1901.

Phacoides muricatus Spengler.

Tellina muricata Spengler, Skrift. Nat. Selsk., 1798, p. 120.
Lucina scabra Lamarck, An. sans Vert., VI, p. 542, 1819; Reeve, Conch. Icon., VI, pl. VIII, fig. 45, 1850.

Shell suborbicular, compressed, rather solid, slightly truncated posteriorly, with numerous radiating rows of ridges alternately larger and smaller, the larger and sometimes the smaller rows beset with elevated, prickly scales; beaks pointed forward and having a few concentric lamellæ; lunule small; left valve with two cardinals, two anterior and two posterior laterals; right valve with two cardinals, the anterior bifid, with one anterior and one posterior lateral; anterior muscle scar long; posterior scar oval; border crenated. Color white.

Length, 13; height, 12; diameter, 4 mm. Mayaguez Harbor, Porto Rico.

Subgenus LUCINOMA Dall, 1901.

Phacoides radians Conrad.

Lucina radians Conrad, Am. Journ. Sci., XLI, p. 347, 1841.
Lucina radiata Conrad, Fos. Medial Tert., p. 70, pl. XL, fig. 3, 1845.

Shell suborbicular, subinflated, rather solid, with moderately high beaks, which are turned forward over a deep lunule; surface everywhere covered with regular, concentric, fine, threadlike ribs, and these are cut by faint, radiating depressions; left valve with two radial, compressed cardinals and a feeble anterior lateral at the base of the lunule; right valve with one compressed cardinal, which is sometimes slightly bifid; beak cavities moderately deep, compressed; anterior muscle scar oblique, rather elongated; posterior scar oval; pallial line deep; border of the shell crenate. Color white.

Length, 18; height, 17.5; diameter, 10 mm.

San Geronimo, Porto Rico, two worn valves.

Genus DIVARICELLA von Martens.

Divaricella quadrisulcata d'Orbigny.

Lucina quadrisulcata d'Orbigny, Voy. Am. Mér., p. 584, 1846; Moll. Cubana, II, p. 294, pl. XXVII, figs. 34-36, 1853.

Shell nearly orbicular, the beaks projecting but slightly above the general outline, subsolid, somewhat inflated, with a very small, imperfectly developed lunule; surface sculptured throughout with rather sharp chevron-shaped ridges whose most elevated points are in a line running from the beaks to a little in front of the middle base; besides it is marked with faint, concentric growth lines and somewhat stronger rest lines; ligament nearly imbedded in a groove of the hinge; right valve with a divided cardinal and a feeble one in front of it; left valve with two cardinals; laterals wanting; borders of the shell finely, often feebly, crenulate. The shell is white throughout, covered, when perfectly fresh, with a thin, straw-colored epidermis.

Length, 25; height, 24; diameter, 14 mm.

Hucares, Porto Rico, one young worn valve.

Very close to *D. dentata* Wood, which has deeper rest marks and is strongly dentate at the rest periods and on the edges.

Family CYRENELLIDÆ.

Genus CYRENOIDA Joannis, 1835.

Cyrenoida americana Morelet. Plate 58, fig. 5.

Cyrenoides americanus Morelet, Test. Nov., II, p. 26, 1851.
Cyrenella americana Shuttleworth, Diagn. Neuer Moll., No. VII, p. 163, 1854.

One specimen in the U. S. National Museum collection was contributed by Walton from Arecibo, Porto Rico, being part of the material from which the species was described. It was first discovered at the Isle of Pines, near Cuba.

Family DIPLODONTIDÆ.

Genus DIPLODONTA Bronn, 1831.

Shell suborbicular, rather thin, white, concentrically striate, without a lunule; hinge with two cardinals in each valve, the posterior in the right and the anterior of the left bifid; lateral teeth wanting; muscular impressions oval, elongated; margins of the shell smooth.

Section DIPLODONTA s. s.

Diplodonta nucleiformis Wagner.

Mysia nucleiformis Wagner, Journ. Acad. Nat. Sci. Phila., VIII, p. 52, pl. I, fig. 4, 1838.
Cytherea sphærica H. C. Lea, Trans. Am. Phil. Soc., 2d series, IX, p. 241, pl. XXXIV, fig. 22, 1845.

Mayaguez Harbor, Porto Rico, at station 6062, in 30 fathoms, sand, and off Culebra Island. Also at St. Thomas and northward to the vicinity of Cape Hatteras, North Carolina, in 15 to 52 fathoms; fossil in the Miocene and upper Oligocene of the eastern United States.

Section PHLYCTIDERMA Dall, 1899.

Diplodonta notata, n. sp.

Shell suborbicular, with rather high, nearly central beaks, scarcely inflated; surface with very delicate growth lines, minutely pitted throughout excepting in the umbonal region; left valve with two cardinals, the hinder compressed, the anterior triangular and deeply bifid; right valve with the hinder tooth bifid and the anterior compressed; ligament almost wholly internal, narrow; muscle scars somewhat elongated; interior rather smooth. Color white.

Length, 9; height, 8.5; diameter, 3.5 mm.

Mayaguez Harbor, Porto Rico, one pair and a single valve. It ranges from Marco, Florida, south to Porto Rico.

Diplodonta puncturella Dall.

Diplodonta puncturella Dall, Trans. Wagner Inst., III, p. 1183, pl. XLV, fig. 26, 1900.

San Juan Harbor, Porto Rico; also Jamaica.

Family CHAMIDÆ.

Genus CHAMA (Linnæus) Lamarck, 1799.

Shell attached, irregular, inequivalve, thick; beaks spiral or subspiral, that of the fixed valve always the longer; surface lamellated; the free valve operculiform, slightly convex, sometimes right and sometimes left; hinge thick, bearing an anterior groove, an oblique, arched cardinal, and an oblique, straight furrow; fixed valve more convex and larger than the other; hinge plate thick, with one strong anterior cardinal and a curved posterior tooth; border of the valves crenated.

Chama macrophylla Gmelin.

Chama macrophylla Gmelin, Syst. Nat., p. 3304, 1792; Chemnitz, Conch. Cab., VII, p. 149, pl. LII, figs. 514, 515.

Quebradillas, Porto Rico (Gundlach).

Chama sarda Reeve.

Chama sarda Reeve, Conch. Icon., IV, pl. VII, fig. 40, 1847.

Shell small, somewhat orbicular; attached valve deeper than the free one, irregular; surface bearing subconcentric rows of wavy scales, white, clouded with brown and white, crimson and white, or crimson, the upper valve often having curved radiating rays of red on a white ground; ligament short, curved; left valve with an anterior tooth, behind which is a pit; right with an anterior pit and behind it a tooth; teeth blunt and rounded; beak cavity of the lower valve deep, that of the upper valve often deep; muscle scars rather long; border faintly crenate.

Length, 27; height, 30; diameter, 23 mm.

San Geronimo, Mayaguez, San Juan, Porto Rico; Vieques; mostly young and worn valves.

This species is much smaller than *C. macrophylla*, and may generally be distinguished by its different and often beautiful color patterns and the crimson and white staining of the free valve.

Subgenus ECHINOCHAMA Fischer, 1887.

Shell nearly regular and equivalve, attached when young by the right valve; lunule large.

Chama arcinella Linnæus.

Chama arcinella Linnæus, Syst. Nat., ed. XII, p. 1139, 1767; Reeve, Conch. Icon., IV, pl. V, fig. 26, *a*, *b*, 1846.

Shell somewhat quadrate, inflated, solid, nearly equivalve, with the beaks curved forward over a large, wide lunule; ligament partly buried; surface covered with very coarse granulations or small pustules, often arranged in rows, and having from eight to twenty curved, radiating, more or less spinose ribs; left valve with one curved cardinal, in front of which is a wide pit with small, radial crenations within it; right valve with a large, sculptured cardinal, which fits into the pit of the left valve; anterior muscle scar elongated; posterior scar oval; beak cavities deep or shallow; border of the valves crenate. Color white without, white or purple within.

Length of a large shell without the spines, 43; height, 40; diameter, 30 mm. Same shell, measuring over all, length, 53; height, 55; diameter, 40 mm.

Mayaguez Harbor, Porto Rico, a number of valves.

The shell is attached when young by the right valve in front of the beak, generally to a piece of shell or to a specimen of its own species. Usually before it becomes adult it is detached, but still carries the scar or a fragment of the object to which it was fastened. Reeve figures a cluster of specimens of this species attached to each other. The nepionic shell is crimson or brown, unattached, and distinctly carditoid.

Family VESICOMYACIDÆ.

Genus VESICOMYA Dall, 1864.

Shell small, smooth, or concentrically striate; hinge like that of *Meiocardia*, but without lateral teeth; epidermis polished; beaks moderately prominent; lunule circumscribed by a groove.

Mr. Smith, of the British Museum, has removed this group from the vicinity of the original *Callocardia* which, according to his observations and those of Sowerby, would belong to *Caryatis* Roemer and be placed in the *Veneridæ*. As the gill of *Vesicomya* is remarkably distinct in structure from any of the *Veneridæ* and indicates that it must be placed in a distinct family, the family name is here modified to accord with the present arrangement, having previously been used as *Callocardiidæ*.

Vesicomya pilula Dall.

Diplodonta pilula Dall, Bull. Mus. Comp. Zool., IX, p. 136, 1881.
Callocardia (*Vesicomya*) *pilula* Dall, Blake Report, pt. I, p. 274, pl. VIII, fig. 13, 1886.

A few broken, worn valves of this species were obtained at Mayaguez.

Family PLEUROPHORIDÆ.

Genus CORALLIOPHAGA Blainville, 1824.

Shell irregular, oblong, oval, or subcylindrical, rayed, smooth or lamellar, very inequilateral, thin; anterior side short; posterior end inflated; beaks rather prominent; hinge with two oblique cardinals in each valve and one posterior lateral; pallial line with a wide but shallow sinus.

Coralliophaga coralliophaga Gmelin.

Chama coralliophaga Gmelin, Syst. Nat., p. 3305, 1792; Chemnitz, Conch. Cat., X, p. 359, pl. 172, figs. 1673, 1674; Blainville Man., pl. 76, fig. 3, 1825.

A fragment of a bivalve, consisting of the beaks and a small part of the valves, which may be this species, was obtained at Puerto Real, Porto Rico. It is common in coral throughout the West Indies.

Family CRASSATELLITIDÆ.

Genus CRASSATELLITES Krüger, 1823.

Shell equivalve, solid, subtriangular, with a distinct lunule; resilium in an internal groove; hinge usually with three cardinals in the right valve and two in the left; adductor muscle scars deep and rounded. It is *Crassatella* of authors, but not of Lamarck, 1799.

Subgenus CRASSINELLA Guppy, 1874.

Shells small, compressed, subtriangular, with two cardinals in each valve, the posterior one often obsolete.

Crassatellites guadelupensis d'Orbigny.

Crassatella guadelupensis d'Orbigny, Moll. Cubana, II, p. 289, pl. XXVII, figs. 24-26, 1845.

Shell small, somewhat inequilateral, irregularly triangular, rather solid, compressed, with sharp, high beaks, which are curved slightly backward over a long escutcheon; lunule long and shallow; surface with a few concentric, raised laminæ, left valve with two cardinals and a posterior lateral with a deep groove above it; right valve with two cardinals and a long anterior lateral with a deep groove above it. Color whitish or brown, sometimes variegated.

Length, 4; height, 3; diameter, 1.5 mm.

Mayaguez, Porto Rico, four worn valves.

The posterior dorsal side is longer than the anterior dorsal side, and its outline is incurved. There are eight or ten concentric lamellæ on adult shells.

Crassatellites martinicensis d'Orbigny.

Crassatella martinicensis d'Orbigny, Moll. Cubana, II, p. 288, pl. XXVII, figs. 21-23, 1845.

Shell very small, with high sharp beaks, the anterior and posterior slopes straight from the beaks, the two standing at a right angle with each other, compressed, the basal line from the lower end of the anterior and posterior slopes well rounded; surface with eight to ten raised, sharp, concentric lamellæ, sometimes ornamented with a few feeble brown rays; hinge much as in *C. guadelupensis*. Color generally whitish.

Length, 2.25; height, 2; diameter, 1 mm.

Mayaguez, a number of valves.

In *C. guadelupensis* the outline of the anterior dorsal truncation is a little convex and that of the posterior dorsal truncation is concave. In *C. martinicensis* both outlines are straight, and the shell is more nearly equilateral.

Order ANOMALODESMACEA.

Superfamily POROMYACEA.

Family CUSPIDARIIDÆ.

Genus CUSPIDARIA Nardo, 1840.

Shell small, corbuliform, rostrate, smooth or sculptured, the radial sculpture, if any, predominant. Gills obsolete, and their remnants seated on a muscular septum between the perivisceral and anal chambers.

Subgenus CUSPIDARIA s. s.

Shell smooth.

Cuspidaria obesa Lovèn.

Neæra obesa Lovèn, Ind. Moll. Scand., p. 48, 1846; G. O. Sars, Moll. Reg. Arct. Norveg., p. 86, pl. 6, fig. 4 *a–c*.

Mayaguez Harbor, Porto Rico, at station 6062, in 30 fathoms, sand; also at Barbados, 100 fathoms, and at many localities in the North Atlantic and arctic seas, commonly in deep water. The presence of this shell and a number of others in comparatively shallow water of high temperature (75.8° F.) is one of the surprises afforded by this collection.

Subgenus CARDIOMYA A. ADAMS.

Shell with radial sculpture.

Cuspidaria perrostrata Dall.

Cuspidaria perrostrata Dall, Blake Report, Biv., p. 296, pl. II, figs. 3*a*, 3*b*, 1881.

Mayaguez Harbor, Porto Rico, in 30 fathoms, at station 6062.

Cuspidaria costellata Deshayes.

Corbula costellata Deshayes, Explor. Sci. Morée, Géol., p. 86, pl. VII, figs. 1-3, 1837.
Sphæna alternata d'Orbigny, Moll. Cubana, II, p. 286, pl. XXVII, figs. 17-20, 1845.

With the last; also northward to North Carolina, in the Mediterranean, etc,

Cuspidaria ornatissima d'Orbigny.

Sphena ornatissima d'Orbigny, Moll. Cubana, II, p. 286, pl. XXVII, figs. 13–16, 1845.
Neæra costata Bush, Trans. Conn. Acad., VI, pt. II, p. 472, pl. XLV, fig. 21, 1885.

Mayaguez Harbor, Porto Rico, at station 6062, in 30 fathoms; also at St. Thomas, Guadeloupe, Martinique, and Cuba (d'Orbigny), and northward to Cape Hatteras, North Carolina.

Family VERTICORDIIDÆ.

Genus VERTICORDIA Wood, 1844.

Subgenus TRIGONULINA d'Orbigny, 1845.

Shell compressed laterally, small, very pearly, suborbicular, with a few very strong arcuate radial ribs, granular surface, and deep lunule; ossiculum long and narrow.

Verticordia ornata d'Orbigny.

Trigonulina ornata d'Orbigny, Moll. Cubana, II, p. 292, pl. XXVII, figs. 30–33, 1845.
Verticordia cælata Verrill, Trans. Conn. Acad., V, p. 566, 1884; VI, pl. XXX, figs. 9, 9a.

Mayaguez Harbor, Porto Rico, at station 6062, in 30 fathoms, sand; also at Barbados, Cuba, Florida, and north to Marthas Vineyard, Masssachusetts, and in Japan, California, and the Mediterranean.

Superfamily ANATINACEA.

Family LYONSIIDÆ.

Genus LYONSIA Turton, 1822.

Shell thin, pearly, longer than high, inequivalve, inequilateral, truncate behind; hinge edentulous, with the ligament in a sulcus, and a large lithodesma; pallial sinus obscure, angular.

Subgenus ENTODESMA Philippi, 1845.

Shell with a strong periostracum, gaping behind, the anterior end short, the surface without notable radial sculpture.

Section ENTODESMA s. s.

Shell large, coarse, opaque, irregular, nestling, subquadrate, with a very large lithodesma. Type, *E. chilense* Philippi.

Section PHILIPPINA Dall, 1901.

Shell small, thin, polished, very inequilateral, anterior end attenuated, very short; gaping below, compressed behind, commensal with sponges or compound ascidians. Type, *L. beana* d'Orbigny.

This is a small but peculiar group which often shows color painting, which the other sections of *Lyonsia* do not. *L. picta* Gray, *L. diaphana* Carpenter, and *L. inflata* Conrad are also probably referable to it.

Lyonsia beana d'Orbigny.

Lyonsia beana d'Orbigny, Moll. Cubana, II, p. 225, pl. XXV, figs. 26–28, 1845.

Vieques; also Cuba and other islands of the West Indies, and north to North Carolina.

It is probable that d'Orbigny intended to name this species after M. Beau, who collected it, but the name is spelled in his text as above and also on the legend to his plate.

SYSTEMATIC CATALOGUE OF THE MOLLUSKS OF PORTO RICO.

Subkingdom MOLLUSCA.

Class CEPHALOPODA.

Order DIBRANCHIATA.

Suborder OCTOPODA.

Family OCTOPODIDÆ.

Genus OCTOPUS Lamarck.

Octopus americanus d'Orbigny.
Octopus granulatus Lamarck.
Octopus tehuelchus d'Orbigny.
Octopus tuberculatus Blainville?.

Suborder SEPIOPHORA.

Family LOLIGINIDÆ.

Genus LOLIGO Lamarck.

Loligo gahi d'Orbigny.

Family SPIRULIDÆ.

Genus SPIRULA Lamarck.

Spirula australis Lamarck.

Class GASTROPODA.

Subclass ANISOPLEURA.

(EUTHYNEURA.)

Order PTEROPODA.

Suborder THECOSOMATA.

Family CAVOLINIIDÆ.

Genus CLEODORA Peron & Lesueur.

Subgenus CRESEIS Rang.

Creseis subula Quoy & Gaimard.

Genus STYLIOLA (Lesueur) Gray.

Styliola acicula Rang.

Genus CUVIERINA Boas.

Cuvierina columnella Rang.

Genus CAVOLINA Abildgaard.

Cavolina trispinosa Lesueur.
Cavolina longirostris Lesueur.
Cavolina uncinata Rang.
Cavolina inflexa Lesueur.
Cavolina gibbosa Rang.

Order OPISTHOBRANCHIATA.

Suborder TECTIBRANCHIATA.

(CEPHALASPIDEA.)

Family ACTÆONIDÆ.

Genus ACTÆON Montfort.

Actæon punctostriatus C. B. Adams.

Family RINGICULIDÆ.

Genus RINGICULA Deshayes.

Ringicula semistriata d'Orbigny.

Family TORNATINIDÆ.

Genus TORNATINA A. Adams.

Tornatina bullata Kiener.
Tornatina candei d'Orbigny.

Genus VOLVULA A. Adams.

Volvula oxytata Bush.
Volvula acuta d'Orbigny.

Genus RETUSA Brown.

Retusa cælata Bush.

Family BULLIDÆ.

Genus BULLA Linnæus.

Bulla amygdala Dillwyn.

Family AKERATIDÆ.

Genus HAMINEA Leach.

Haminea elegans Gray.
Haminea succinea Conrad.

Family HYDATINIDÆ.

Genus HYDATINA Schumacher.

Hydatina physis Linnæus.

Genus MICROMELO Pilsbry.

Micromelo undata Bruguière.

Family SCAPHANDRIDÆ.

Genus ATYS Montfort.

Subgenus ATYS s. s.

Atys guildinii Sowerby.
Atys sandersoni Dall.

Systematic catalogue of the mollusks of Porto Rico—Continued.

(Anaspidea.)

Family Aplysiidæ.

Subfamily Aplysinæ.

Genus Tethys Linnæus.

Tethys protea Rang.
Tethys cervina Dall & Simpson.
Tethys parvula (Guilding) Mörch.

Subfamily Dolabriferinæ.

Genus Dolabrifera Gray.

Dolabrifera ascifera Rang.
Dolabrifera sowerbyi Guilding.

Genus Notarchus Cuvier.

Notarchus pleii Rang.

(Notaspidea.)

Family Pleurobranchidæ.

Genus Pleurobranchus Cuvier.

Pleurobranchus lacteus Dall & Simpson.

Order Nudibranchiata.

Family Dorididæ Cryptobranchiatæ.

Genus Geitodoris Bergh.

Geitodoris mollina Bergh.

Order Pulmonata.

Suborder Basommatophora.

Superfamily Akteophila.

Family Auriculidæ.

Genus Melampus Montfort.

Subgenus Melampus s. s.

Melampus coffeus Linnæus.
Melampus flavus (Gmelin?) Binney.

Genus Tralia Gray.

Subgenus Tralia s. s.

Tralia pusilla Gmelin.

Genus Pedipes Scopoli.

Pedipes mirabilis Mühlfeld.

Genus Blauneria Shuttleworth.

Blauneria heteroclita Montagu.

Superfamily Limnophila.

Family Limnæidæ.

Subfamily Limnæinæ.

Genus Limnæa Lamarck.

Limnæa cubensis Pfeiffer.

Subfamily Planorbinæ.

Genus Planorbis Geoffroy.

Planorbis guadaloupensis Sowerby.
Planorbis tumidus Pfeiffer.
Planorbis riisei Dunker.
Planorbis refulgens Dunker.
Planorbis haldemani C. B. Adams.
Planorbis schrammi Crosse.
Planorbis lucidus Pfeiffer.
Planorbis macnabianus C. B. Adams.
Planorbis circumlineatus Shuttleworth.

Genus Planorbula Haldeman.

Planorbula albicans Pfeiffer.

Family Ancylidæ.

Genus Ancylus Geoffroy.

Ancylus obscurus Haldeman.
Ancylus beaui Bourguignat.

Family Physidæ.

Genus Aplexa Fleming.

Aplexa sowerbyana d'Orbigny.

Suborder Stylommatophora.

Superfamily Ditremata.

(Vasopulmonata).

Family Onchidiidæ.

Genus Onchidella Gray.

Onchidella floridana Dall.

Family Veronicellidæ.

Genus Veronicella Blainville.

Veronicella occidentalis Guilding.

(Orthurethra.)

Family Pupidæ.

Genus Bifidaria Sterki.

Bifidaria pellucida Pfeiffer.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Genus PUPOIDES Pfeiffer.

Pupoides marginatus Say.

Genus VERTIGO Müller.

Vertigo hexodon C. B. Adams.

(HETERURETHRA.)

ELASMOGNATHA.

Family SUCCINEIDÆ.

Genus SUCCINEA Draparnaud.

Succinea hyalina Shuttleworth.
Succinea approximans Shuttleworth.
Succinea riisei Pfeiffer.

(SIGMURETHRA.)

AULACOPODA.

Family ZONITIDÆ.

Genus VITREA Fitzinger.

Vitrea insecta von Martens.
Vitrea bryodes Shuttleworth.

Genus ZONITOIDES Lehmann.

Zonitoides minusculus Binney.

Genus GUPPYA Mörch.

Guppya gundlachi Pfeiffer.

(AGNATHOMORPHA.)

Family GLANDINIDÆ.

Genus GLANDINA Schumacher.

Glandina portoricensis Pfeiffer.
Glandina terebræformis Shuttleworth.
Glandina sulculosa Shuttleworth.
Glandina interrupta Shuttleworth.
Glandina glabra Pfeiffer.

Family CIRCINARIIDÆ.

Genus CIRCINARIA Beck.

Circinaria concolor Férussac.

(HOLOPODA.)

Family STENOGYRIDÆ.

Genus LEPTINARIA Beck.

Leptinaria antillarum Shuttleworth.
Leptinaria stylodon Shuttleworth.
Leptinaria opalescens Shuttleworth.

Genus STENOGYRA Shuttleworth.

Stenogyra terebraster Lamarck.
Stenogyra swiftiana Pfeiffer.

Genus OPEAS Albers.

Opeas subula Pfeiffer.
Opeas micrus d'Orbigny.
Opeas margaritaceus Shuttleworth.
Opeas alabastrinus Shuttleworth.
Opeas gompharium Shuttleworth.
Opeas goodallii Miller.

Genus SUBULINA Beck.

Subulina octona Bruguière.
Subulina acicularis Shuttleworth.

Genus SPIRAXIS C. B. Adams.

Spiraxis paludinoides d'Orbigny.

Genus PSEUDOBALEA Shuttleworth.

Pseudobalea dominicensis Pfeiffer.

Family CLAUSILIIDÆ.

Genus CLAUSILIA Draparnaud.

Clausilia bicanaliculata Férussac.

Family UROCOPTIDÆ.

Genus PINERIA Poey.

Pineria viequensis Pfeiffer.

Genus CERION Bolten.

Subgenus STROPHIOPS Dall.

Cerion crassilabre Sowerby.
Cerion striatellum (Férussac) Guérin.
Cerion microstoma Pfeiffer.

Genus MACROCERAMUS Guilding.

Macroceramus microdon Pfeiffer.
Macroceramus shuttleworthi von Martens.
Macroceramus johannis Pfeiffer.

Genus BRACHYPODELLA Beck.

Brachypodella pallida Guilding.
Brachypodella portoricensis Pfeiffer.
Brachypodella riisei Pfeiffer.

Family BULIMULIDÆ.

Subfamily AMPHIBULIMINÆ.

Genus SIMPULOPSIS Beck.

Subgenus PLATYSUCCINEA Ancey.

Simpulopsis portoricensis Shuttleworth.
Simpulopsis psidii von Martens.

Genus GÆOTIS Shuttleworth.

Gæotis nigrolineata Shuttleworth.
Gæotis flavolineata Shuttleworth.
Gæotis malleata Pilsbry.
Gæotis albopunctulata Shuttleworth.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Subfamily BULIMULINÆ.

Genus BULIMULUS Leach.

Subgenus BULIMULUS s. s.

Bulimulus exilis Gmelin.
Bulimulus exilis var. *eyriesii* Drouet.
Bulimulus diaphanus Pfeiffer.

Genus DRYMÆUS Albers.

Subgenus DRYMÆUS s. s.

Drymæus hjalmarsoni Pfeiffer.
Drymæus liliaceus Férussac.
Drymæus elongatus Bolten.

Family HELICIDÆ.

Subfamily SAGDINÆ.

Genus THYSANOPHORA Strebel & Pfeffer.

Thysanophora dioscoricola C. B. Adams.
Thysanophora plagioptycha Shuttleworth.
Thysanophora krugiana von Martens.
Thysanophora vortex Pfeiffer.
Thysanophora subaquila Shuttleworth.
Thysanophora euclasta Shuttleworth.
Thysanophora musicola Shuttleworth.
Thysanophora portoricensis Pfeiffer.
Thysanophora velutina Lamarck.
Thysanophora arecibensis Pfeiffer.

Subfamily HELICINÆ.

Genus CEPOLIS Montfort.

Cepolis dermatina Shuttleworth.
Cepolis squamosa Férussac.
Cepolis riisei Pfeiffer.
Cepolis diaphana Lamarck.

Subfamily CAMÆNINÆ.

Genus PLEURODONTE F. de Waldheim.

Subgenus PLEURODONTE s. s.

Pleurodonte carocolla Linnæus.
Pleurodonte bornii Pfeiffer.

Subgenus POLYDONTES Montfort.

Pleurodonte angulata Férussac.
Pleurodonte obliterata Férussac.
Pleurodonte luquillensis Shuttleworth.
Pleurodonte lima Férussac.
Pleurodonte castrensis Pfeiffer.
Pleurodonte incerta Férussac.

Superorder STREPTONEURA.

Order CTENOBRANCHIATA.

Suborder ORTHODONTA.

Superfamily TOXOGLOSSA.

Family TEREBRIDÆ.

Genus TEREBRA Bruguière.

Terebra cinerea Born.
Terebra hastata Gmelin.
Terebra protexta Conrad.
Terebra juanica Dall & Simpson.
Terebra nassula Dall.
Terebra limatula var. *acrior* Dall.

Family CONIDÆ.

Genus CONUS Linnaeus.

Conus delesserti Recluz.
Conus agassizii Dall.
Conus pygmæus Reeve.
Conus verrucosus Hwass.
Conus mus Hwass.
Conus nebulosus Solander.
Conus testudinarius Hwass.

Family PLEUROTOMIDÆ.

Genus PLEUROTOMA Lamarck.

Subgenus PLEUROTOMA s. s.

Pleurotoma albida Perry.

Subgenus ANCISTROSYRINX Dall.

Pleurotoma radiata Dall.

Genus DRILLIA Gray.

Drillia ostrearum Stearns.
Drillia albicoma Dall.
Drillia eucosmia Dall, var. *canna* Dall.
Drillia nigrescens Gray.
Drillia? actinocycla Dall & Simpson.
Drillia gundlachi Dall & Simpson.
Drillia ponciana Dall & Simpson.
Drillia melonesiana Dall & Simpson.
Drillia interpleura Dall & Simpson.
Drillia albinodata Reeve.
Drillia albocincta C. B. Adams.
Drillia solida C. B. Adams.
Drillia thea Dall.
Drillia æpynota Dall.
Drillia lissotropis Dall.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Genus BORSONIA Bellardi.

Subgenus CORDIERIA Rouault.

Borsonia rouaulti Dall.

Genus MANGILIA (Leach) Risso.

Subgenus CYTHARA Schumacher.

Mangilia asarca Dall & Simpson.
Mangilia balteata Reeve.
Mangilia densestriata C. B. Adams.
Mangilia psila Bush.
Mangilia biconica C. B. Adams.

Subgenus DAPHNELLA Hinds.

Mangilia morra Dall.
Mangilia elata Dall.

Subgenus GLYPHOSTOMA Gabb.

Mangilia aguadillana Dall & Simpson.

Subgenus MANGILIA s. s.

Mangilia luctuosa d'Orbigny.
Mangilia quadrata Reeve.
Mangilia lavalleana d'Orbigny.
Mangilia rubella Kurtz & Stimpson?.
Mangilia melanitica Dall.
Mangilia trilineata C. B. Adams.

Family CANCELLARIIDÆ.

Genus CANCELLARIA Lamarck.

Subgenus CANCELLARIA s. s.

Cancellaria reticulata Linnæus.

Subgenus TRIGONOSTOMA Blainville.

Cancellaria agassizii Dall.

Superfamily RACHIGLOSSA.

Family OLIVIDÆ.

Genus OLIVA Bruguière.

?*Oliva litterata* Lamarck.
Oliva reticularis Lamarck.
Oliva caribæensis Dall & Simpson.

Genus OLIVELLA Swainson.

Olivella jaspidea Gmelin.
Olivella esther Duclos.
Olivella mutica Say.
Olivella rotunda Dall.
Olivella oryza Lamarck.
Olivella nivea Gmelin.
Olivella verreauxi Duclos.

Family MARGINELLIDÆ.

Genus MARGINELLA Lamarck.

Marginella apicina Menke.
Marginella hematita Kiener.
Marginella striata Sowerby.
Marginella evadne Dall & Simpson.
Marginella torticula Dall.
Marginella avena Valenciennes.
Marginella albolineata d'Orbigny.
Marginella lactea Kiener.
Marginella fusca Sowerby.
Marginella subtriplicata d'Orbigny.
Marginella pallida Donovan.

Subgenus PERSICULA Schumacher.

Marginella catenata Montagu.
Marginella catenata var. *pulcherrima* Gaskoin.
Marginella interruptelineata Mühlfeld.

Subgenus VOLUTELLA Swainson.

Marginella ovuliformis d'Orbigny.

Family VOLUTIDÆ.

Genus VOLUTA (Linnæus) Lamarck.

Voluta musica Linnæus.

Family TURBINELLIDÆ.

Genus TURBINELLA Lamarck.

Subgenus VASUM Link.

Turbinella muricata Born.

Family MITRIDÆ.

Genus MITRA Lamarck.

Mitra barbadensis Gmelin.
Mitra nodulosa Gmelin.
Mitra hanleyi var. *gemmata* Sowerby.
Mitra straminea A. Adams.
Mitra microzonias Lamarck.

Genus MITROMORPHA A. Adams.

Mitromorpha biplicata Dall.

Family FASCIOLARIIDÆ.

Genus FASCIOLARIA Lamarck.

Fasciolaria gigantea Kiener.
Fasciolaria tulipa Linnæus.

Genus LATIRUS Montfort.

Subgenus LEUCOZONIA Gray.

Latirus cinguliferus Lamarck.
Latirus ocellatus Gmelin.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Subgenus LATIRUS s. s.

Latirus brevicaudatus Reeve.
Latirus infundibulum Gmelin.

Family BUCCINIDÆ.

Genus PISANIA Bivona.

Pisania pusio Linnæus.

Genus TRITONIDEA Swainson.

Tritonidea tincta Conrad.
Tritonidea tincta var. *bermudensis* Dall.
Tritonidea auritula Link.
Tritonidea orbignyi Payraudeau.

Genus NASSARINA Dall.

Nassarina glypta Bush.
Nassarina metabrunnea Dall & Simpson.

Genus PHOS Montfort.

Phos candei d'Orbigny.
Phos parvus C. B. Adams.
Phos oxyglyptus Dall & Simpson.

Genus STRONGYLOCERA Mörch.

Strongylocera unicincta Say.

Genus ENGINA Gray.

Engina turbinella Kiener.

Family NASSIDÆ.

Genus NASSA Lamarck.

Nassa vibex Say.
Nassa ambigua Montagu.
Nassa hotessieri d'Orbigny.

Family COLUMBELLIDÆ.

Genus COLUMBELLA Lamarck.

Subgenus COLUMBELLA s. s.

Columbella mercatoria (Linnæus) Lam.

Subgenus ANACHIS H. & A. Adams.

Columbella pulchella Kiener.
Columbella iontha Ravenel.
Columbella catenata Sowerby.
Columbella obesa C. B. Adams.
Columbella calliglypta Dall & Simpson.

Subgenus ASTYRIS H. & A. Adams.

Columbella duclosiana d'Orbigny.
Columbella perpicta Dall & Simpson.

Genus NITIDELLA Swainson.

Nitidella nitidula Linnæus.
Nitidella lævigata Linnæus.
Nitidella cribraria Lamarck.

Genus PYRENE Bolten.

Pyrene ovulata Lamarck.

Family MURICIDÆ.

Subfamily MURICINÆ.

Genus MUREX Linnæus.

Subgenus MUREX s. s.

Murex messorius Sowerby.
Murex antillarum Hinds.

Subgenus CHICOREUS Montfort.

? *Murex rufus* Lamarck.
Murex brevifrons Lamarck.

Subgenus PHYLLONOTUS Swainson.

Murex pomum Gmelin.
Murex micromeris Dall.

Subgenus FAVARTIA Jousseaume.

Murex cellulosus Conrad.
Murex intermedius C. B. Adams.

Genus MURICIDEA (Swainson) Mörch.

Subgenus MURICIDEA s. s.

Muricidea hexagona Lamarck.

Subgenus PSEUDONEPTUNEA Kobelt.

Muricidea multangula Philippi.

Genus ASPELLA Mörch.

Aspella scalaroides Blainville.

Subfamily PURPURINÆ.

Genus PURPURA Bruguière.

Purpura patula Linnæus.
Purpura hæmastoma var. *undata* Lam.
Purpura hæmastoma var. *floridana* Conrad.
Purpura trinitatensis Guppy.
Purpura deltoidea Lamarck.

Genus SISTRUM Montfort.

Sistrum nodulosum C. B. Adams.

Family CORALLIOPHILIDÆ.

Genus CORALLIOPHILA H. & A. Adams.

Coralliophila abbreviata Lamarck.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Superfamily STREPTODONTA.

Family SCALIDÆ.

Genus SCALA (Humphrey) auctorum.

Scala angulata Say.
Scala turricula Sowerby.
Scala unifasciata Sowerby.
Scala eulita Dall & Simpson.

Subgenus ACRILLA Adams.

Scala retifera Dall.

Superfamily GYMNOGLOSSA.

Family EULIMIDÆ.

Genus EULIMA Risso.

Eulima oleacea Kurtz & Stimpson.
Eulima conoidea Kurtz & Stimpson.

Subgenus LEIOSTRACA H. & A. Adams.

Eulima patula Dall & Simpson.
Eulima acuta Sowerby.

Genus NISO Risso.

Niso portoricensis Dall & Simpson.

Family PYRAMIDELLIDÆ.

Genus PYRAMIDELLA Lamarck.

Pyramidella subdolabrata Mörch.

Genus TURBONILLA Risso.

Turbonilla reticulata C. B. Adams?.
Turbonilla portoricana Dall & Simpson.
Turbonilla insularis Dall & Simpson.

Superfamily NUCLEOBRANCHIATA.

Family ATLANTIDÆ.

Genus ATLANTA Lesueur.

Atlanta peronii Lesueur.

Superfamily TÆNIOGLOSSA.

Family SEPTIDÆ.

Genus DISTORTRIX Link.

Distortrix reticulata Link.
Distortrix reticulata var. *clathrata* Dall.

Genus GYRINEUM Link.

Gyrineum cruentatum Reeve.

Genus SEPTA Perry.

Septa tritonis var. *nobilis* Conrad.

Genus COLUBRARIA Schumacher.

Colubraria lanceolata Menke.

Genus RANULARIA Schumacher

Ranularia tuberosa Lamarck.

Genus LAMPUSIA Schumacher.

Lampusia pilearis Lamarck.
Lampusia chlorostoma Lamarck.
Lampusia cynocephala Lamarck.

Genus LOTORIUM Montfort.

Lotorium femorale Linnæus.

Family CASSIDIDÆ.

Genus CASSIS Lamarck.

Subgenus CASSIS s. s.

Cassis tuberosa Linnæus.
Cassis flammea Linnæus.

Subgenus CYPRÆCASSIS Stutchbury.

Cassis testiculus Linnæus.

Subgenus SEMICASSIS Mörch.

Cassis inflata Shaw.

Genus SCONSIA Gray.

Sconsia striata Lamarck.

Genus LAMBIDIUM Link.

Lambidium oniscus Linnæus.

Family DOLIIDÆ.

Genus DOLIUM Lamarck.

Dolium perdix Linnæus.
Dolium galea Linnæus.

Family AMPHIPERASIDÆ.

Genus ULTIMUS Montfort.

Ultimus gibbosus Linnæus.

Family CYPRÆIDÆ.

Genus CYPRÆA Linnæus.

Cypræa exanthema Linnæus.
Cypræa cinerea Gmelin.
Cypræa spurca Linnæus.

Family TRIVIIDÆ.

Genus TRIVIA Gray

Trivia pediculus Linnæus.
Trivia quadripunctata Gray.
Trivia quadripunctata var. *rotunda* Kiener.

Genus ERATO Risso.

Erato maugeriæ Gray.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Family Strombidæ.

Subfamily Strombinæ.

Genus Strombus Linnæus.

Strombus gigas Linnæus.
Strombus pugilis Linnæus.
Strombus costatus Gmelin.
Strombus bituberculatus Lamarck.
Strombus gallus Linnæus.

Family Triforidæ.

Genus Triforis Deshayes.

Subgenus Triforis s. s.

Triforis turristhomæ Dillwyn.
Triforis melanura C. B. Adams.
Triforis intermedia C. B. Adams.
Triforis samanæ Dall.

Family Cerithiopsidæ.

Genus Seila A. Adams.

Seila terebralis C. B. Adams.

Genus Cerithiopsis Forbes & Hanley.

Cerithiopsis crystallina Dall.
Cerithiopsis pulchella Jeffreys.
Cerithiopsis pupa Dall & Simpson.
Cerithiopsis subulata Montagu.

Family Cerithiidæ.

Genus Cerithium Bruguière.

Cerithium algicola C. B. Adams.
Cerithium uncinatum Gmelin.
Cerithium atratum Born.
Cerithium litteratum Born.
Cerithium litteratum var. *semiferrugineum* Lamarck.
Cerithium variabile C. B. Adams.
Cerithium minimum Gmelin.

Genus Pyrazus Montfort.

Pyrazus degeneratus Dall.

Genus Bittium (Leach) Gray.

Subgenus Diastoma Deshayes.

Bittium varium Pfeiffer.
Bittium cerithidioide Dall.

Family Modulidæ.

Genus Modulus Gray.

Modulus modulus Linnæus.
Modulus catenulatus Philippi.

Family Planaxidæ.

Genus Planaxis Lamarck.

Planaxis nucleus Wood.
Planaxis lineatus Da Costa.

Family Vermetidæ.

Genus Vermicularia Lamarck.

Vermicularia spirata Philippi.

Genus Petaloconchus Lea.

Petaloconchus erectus Dall.

Genus Bivonia Gray.

Bivonia decussata Lamarck.

Family Turritellidæ.

Genus Turritella Lamarck.

Turritella variegata Linnæus.
Turritella exoleta Linnæus.

Family Litorinidæ.

Genus Litorina Férussac.

Litorina ziczac Gmelin.
Litorina ziczac var. *lineata* Lamarck.
Litorina tessellata Philippi.
Litorina angulifera Lamarck.
Litorina columellaris d'Orbigny.
Litorina guttata Philippi.
Litorina mespilum Muhlfeld.

Genus Tectarius Valenciennes.

Tectarius muricatus Linnæus.
Tectarius trochiformis Dillwyn.

Family Litiopidæ.

Genus Alaba A. Adams.

Alaba tervaricosa C. B. Adams.

Family Solariidæ.

Genus Solarium Lamarck.

Solarium nobile Hanley.
Solarium bisulcatum d'Orbigny.
Solarium krebsii Mörch.

Genus Torinia Gray.

Torinia cylindrica Gmelin.
Torinia æthiops Menke.

Genus Omalaxis Deshayes.

Omalaxis exquisita Dall & Simpson.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Family RISSOIDÆ.

Genus RISSOA Fréminville.

Rissoa epima Dall & Simpson.
Rissoa portoricana Dall & Simpson.

Genus RISSOINA d'Orbigny.

Rissoina decussata Montagu.
Rissoina browniana d'Orbigny.
Rissoina chesnelii Michaud.
Rissoina cancellata Philippi.

Subfamily HYDROBIINÆ.

Genus POTAMOPYRGUS Stimpson.

Potamopyrgus coronatus Pfeiffer.
Potamopyrgus coronatus var. *crystallinus* Shuttleworth.

Family CYCLOPHORIDÆ.

Genus MEGALOMASTOMA Guilding.

Megalomastoma croceum Gmelin.
Megalomastoma croceum var. *curtum* Dall & Simpson.
Megalomastoma hjalmarsoni Pfeiffer.
Megalomastoma verruculosum Shuttlew.

Family CYCLOSTOMATIDÆ.

Genus CHOANOPOMA Pfeiffer.

Choanopoma decussatum Lamarck.
Choanopoma senticosum Shuttleworth.
Choanopoma sulculosum Pfeiffer.

Genus CISTULA Gray.

Cistula riisei Pfeiffer.
Cistula aguadillensis Pfeiffer.
Cistula lineolata Lamarck.

Genus CHONDROPOMA Pfeiffer.

Chondropoma terebra Pfeiffer.
Chondropoma blauneri Shuttleworth.
Chondropoma swifti Shuttleworth.
Chondropoma newtoni Shuttleworth.

Family TRUNCATELLIDÆ.

Genus TRUNCATELLA Risso.

Truncatella caribæënsis Sowerby.
Truncatella subcylindrica Linnæus.
Truncatella pulchella Pfeiffer.
Truncatella clathrus Lowe.

Family CALYPTRÆIDÆ.

Genus CHEILEA Modeer.

Cheilea equestris Linnæus.

Genus CALYPTRÆA Lamarck.

Calyptræa candeana d'Orbigny.

Genus CREPIDULA Lamarck.

Crepidula aculeata Gmelin.
Crepidula riisei Dunker.
Crepidula protea d'Orbigny.

Family AMALTHEIDÆ.

Genus AMALTHEA Schumacher.

Amalthea antiquata Linnæus.
Amalthea subrufa Lamarck.

Family XENOPHORIDÆ.

Genus XENOPHORA Fischer de Waldheim.

Xenophora caribæa Petit.

Family NATICIDÆ.

Genus NATICA Scopoli.

Natica canrena (Linnæus) auctorum.
Natica sagraiana d'Orbigny.

Section STIGMAULAX Mörch.

Natica sulcata Born.

Genus POLINICES Montfort.

Subgenus PAYRAUDEAUTIA Bucquoy, Dautzenberg & Dollfus.

Polinices nubila Dall.

Subgenus MAMILLA Schumacher.

Polinices uberina d'Orbigny.
Polinices lactea Guilding.
Polinices mamillaris Lamarck.

Genus SIGARETUS Lamarck.

Sigaretus martinianus Philippi.

Superfamily DOCOGLOSSA.

Family ACMÆIDÆ.

Genus ACMÆA Eschscholtz.

Acmæa candeana d'Orbigny.
Acmæa punctulata Gmelin.
Acmæa punctulata var. *pulcherrima* Guilding.
Acmæa leucopleura Gmelin.

Superfamily RHIPIDOGLOSSA.

Family COCCULINIDÆ.

Genus COCCULINA Dall.

Cocculina portoricensis Dall & Simpson.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Family PHASIANELLIDÆ.

Genus PHASIANELLA Lamarck.

Phasianella umbilicata d'Orbigny.
Phasianella tessellata Potiez & Michaud.

Family TURBINIDÆ.

Genus TURBO Linnæus.

Turbo castaneus Gmelin.

Genus ASTRALIUM Link.

Astralium cœlatum Gmelin.
Astralium tuber Linnæus.
Astralium longispinum Lamarck.
Astralium americanum Gmelin.

Family TROCHIDÆ.

Genus CHLOROSTOMA Swainson.

Subgenus OMPHALIUS Philippi.

Chlorostoma scalare Anton.
Chlorostoma fasciatum Born.
Chlorostoma excavatum Lamarck.
Chlorostoma maculostriatum C. B. Adams.

Genus LIVONA Gray.

Livona pica Linnæus.

Genus MICROGAZA Dall.

Microgaza rotella Dall.

Genus SOLARIELLA Searles Wood.

Solariella amabilis Jeffreys.

Genus CALLIOSTOMA Swainson.

Calliostoma jujubinum Gmelin.
Calliostoma jujubinum var. *rawsoni* Dall.

Family LIOTIIDÆ.

Genus LIOTIA Gray.

Liotia gemma Tuomey & Holmes.

Family VITRINELLIDÆ.

Genus LEPTOGYRA Bush.

Leptogyra inconspicua Bush.

Family NERITIDÆ.

Genus NERITA (Linnæus) Lamarck.

Nerita peloronta Linnæus.
Nerita tessellata Gmelin.
Nerita tessellata var. *præcognita* C. B. Adams.
Nerita versicolor Lamarck.

Genus NERITINA Lamarck.

Neritina reclivata Say.
Neritina virginea Linnæus.
Neritina viridis Linnæus.

Family HELICINIDÆ.

Genus HELICINA Lamarck.

Helicina vinosa Shuttleworth.
Helicina umbonata Shuttleworth.
Helicina hjalmarsoni Pfeiffer.
Helicina striata Lamarck.
Helicina subfusca Menke.
Helicina fasciata Lamarck.
Helicina phasianella Sowerby.
Helicina trochulina d'Orbigny.
Helicina foveata Pfeiffer.

Genus STOASTOMA C. B. Adams.

Stoastoma portoricense Pfeiffer.

Superfamily ZYGOBRANCHIA.

Family FISSURELLIDÆ.

Subfamily FISSURELLINÆ.

Genus FISSURELLA Bruguière.

Subgenus FISSURELLA s. s.

Fissurella barbadensis Gmelin.
Fissurella rosea Gmelin.
Fissurella nodosa Born.

Subgenus CLYPIDELLA Swainson.

Fissurella fascicularis Lamarck.

Subfamily FISSURELLIDINÆ.

Genus LUCAPINELLA Pilsbry.

Lucapinella limatula Reeve.

Genus LUCAPINA Gray.

Lucapina adspersa Philippi.
Lucapina cancellata Sowerby.

Subfamily EMARGINULINÆ.

Genus FISSURIDEA Swainson.

Fissuridea listeri d'Orbigny.
Fissuridea alternata Say.
Fissuridea alternata var. *dysoni* Reeve.
Fissuridea alternata var. *sayi* Dall.
Fissuridea variegata Sowerby.
Fissuridea viridula Lamarck.

Genus SUBEMARGINULA Blainville.

Subemarginula octoradiata A. Adams.
Subemarginula notata Linnæus.
Subemarginula rollandi Fischer.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Subclass AMPHINEURA.

Order POLYPLACOPHORA.

Family LEPIDOPLEURIDÆ.

Genus LEPIDOPLEURUS Risso.

Levidopleurus pergranatus Dall.

Family CHITONIDÆ.

Subfamily ISCHNOCHITONINÆ.

Genus CHÆTOPLEURA Shuttleworth.

Chætopleura janeirensis Gray.

Genus ISCHNOCHITON Gray.

Subgenus STENOPLAX Carpenter.

Ischnochiton limaciformis Sowerby.
Ischnochiton purpurascens C. B. Adams.
Ischnochiton floridanus Pilsbry.

Subgenus TRACHYDERMON Carpenter.

Ischnochiton liozonis Dall & Simpson.

Subgenus ISCHNOCHITON s. s.

Ischnochiton striolatus Gray.
Ischnochiton striolatus var. *funiculatus* Carpenter.
Ischnochiton papillosus C. B. Adams.
Ischnochiton reticulatus Reeve.

Subfamily CHITONIDÆ.

Genus CHITON Linnæus.

Chiton tuberculatus Linnæus.
Chiton tuberculatus var. *assimilis* Reeve.
Chiton squamosus Linnæus.
Chiton viridis Spengler.
Chiton marmoratus Gmelin.

Genus ACANTHOPLEURA Guilding.

Acanthopleura granulata Gmelin.
Acanthopleura granulata var. *mucronulata* Shuttleworth.

Genus CERATOZONA Dall.

Ceratozona rugosa Sowerby.

Genus ACANTHOCHITES Risso.

Acanthochites spiculosus Reeve.
Acanthochites spiculosus var. *astriger* Reeve.
Acanthochites hemphilli Pilsbry.

Class SCAPHOPODA.

Order SOLENOCONCHA.

Family DENTALIIDÆ.

Genus DENTALIUM Linnæus.

Subgenus DENTALIUM s. s.

Dentalium gouldii Dall.

Subgenus ANTALIS H. & A. Adams.

Dentalium taphrium Dall.
Dentalium disparile d'Orbigny.
Dentalium ceratum Dall.
Dentalium antillarum d'Orbigny.

Subgenus LÆVIDENTALIUM Cossmann.

Dentalium callipeplum Dall.
Dentalium matara Dall.

Subgenus EPISIPHON Pilsbry & Sharp.

Dentalium filum Sowerby.

Subgenus FUSTIARIA Stoliczka.

Dentalium stenoschisma Pilsb. & Sh.

Genus CADULUS Philippi.

Cadulus carolinensis var. *bushii* Dall.
Cadulus minusculus Dall.
Cadulus amiantus Dall.
Cadulus acus Dall.

Class PELECYPODA.

Order PRIONODESMACEA.

Superfamily NUCULACEA.

Family NUCULIDÆ.

Genus NUCULA Lamarck.

Nucula ægeënsis Jeffreys.

Family LEDIDÆ.

Genus LEDA Schumacher.

Leda acuta Conrad.

Genus NEILONELLA Dall.

Neilonella corpulenta Dall.

Superfamily ARCACEA.

Family ARCIDÆ.

Subfamily PECTUNCULINÆ.

Genus GLYCYMERIS Da Costa.

Glycymeris pennaceus Lamarck.
Glycymeris pectinatus Gmelin.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Subfamily ARCINÆ.

Genus ARCA Linnæus.

Subgenus ARCA Linnæus.

Arca occidentalis Philippi.
Arca umbonata Lamarck.

Subgenus BARBATIA (Gray) Adams.

Arca barbata Linnæus.
Arca candida Gmelin.
Arca reticulata Gmelin.
Arca adamsi (Shuttleworth) Smith.

Subgenus SCAPHARCA (Gray) Dall.

Arca campechensis Gmelin.
Arca deshayesii Hanley.
Arca secticostata Reeve.
Arca chemnitzi Philippi.

Superfamily PTERIACEA.

Genus PINNA Lamarck.

Pinna carnea Gmelin.

Genus ATRINA Gray.

Atrina rigida Dillwyn.

Family MELINIDÆ.

Genus MELINA Retzius.

Melina alata Gmelin.
Melina listeri Hanley.
Melina semiaurita Linnæus.

Family PTERIIDÆ.

Genus PTERIA Scopoli.

Pteria radiata Leach.

Superfamily OSTREIDÆ.

Family OSTREIDÆ.

Genus OSTREA Linnæus.

Ostrea virginica Gmelin.
Ostrea cristata Born.
Ostrea frons Linnæus.

Family PECTINIDÆ.

Genus PECTEN Müller.

Subgenus PECTEN s. s.

Pecten laurenti Gmelin.
Pecten ziczac Linnæus.
Pecten medius Lamarck.

Subgenus CHLAMYS Bolten.

Pecten mayaguezensis Dall & Simpson.
Pecten gibbus Linnæus.
Pecten nodosus Linnæus.
Pecten ornatus Lamarck.
Pecten lemniscatus Reeve.
Pecten exasperatus Sowerby.
Pecten antillarum Recluz.

Subgenus AMUSIUM Bolten.

Pecten nanus Verrill & Smith.
Pecten pourtalesianus Dall.

Family SPONDYLIDÆ.

Genus SPONDYLUS Linnæus.

Spondylus echinatus Martyn.

Genus PLICATULA Lamarck.

Plicatula gibbosa Lamarck.

Family LIMIDÆ.

Genus LIMA (Bruguière) Cuvier.

Lima scabra Born.
Lima scabra var. *tenera* Sowerby.
Lima lima Linnæus.
Lima inflata Lamarck.
Lima hians Gmelin.

Genus LIMATULA S. Wood.

Limatula subauriculata Montagu.

Superfamily ANOMIACEA.

Family ANOMIIDÆ.

Genus ANOMIA (Linnæus) Müller.

Anomia simplex d'Orbigny.

Genus PODODESMUS Philippi.

Pododesmus rudis Broderip.

Superfamily MYTILACEA.

Family MYTILIDÆ.

Genus MYTILUS Bolten.

Mytilus hamatus Say.
Mytilus exustus Linnæus.

Genus MODIOLUS Lamarck.

Modiolus tulipus Lamarck.
Modiolus arborescens Dillwyn.
Modiolus cinnamomeus Lamarck.
Modiolus coralliophagus Gmelin.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Genus LITHOPHAGA Bolten.

Lithophaga antillarum d'Orbigny.
Lithophaga bisulcata d'Orbigny.

Genus CRENELLA Brown.

Crenella divaricata d'Orbigny.

Genus MODIOLARIA Beck.

Modiolaria lateralis Say.

Order TELEODESMACEA.

Superfamily MYACEA.

Family GASTROCHÆNIDÆ.

Genus GASTROCHÆNA Cuvier.

Gastrochæna cuneiformis Spengler.

Family SAXICAVIDÆ.

Genus SAXICAVELLA Fischer.

Saxicavella sagrinata Dall & Simpson.

Family CORBULIDÆ.

Genus CORBULA Lamarck.

Corbula disparilis d'Orbigny.
Corbula dietziana C. B. Adams.
Corbula swiftiana C. B. Adams.
Corbula æquivalvis Philippi.
Corbula caribæa d'Orbigny.

Family MYACIDÆ.

Genus SPHENIA Turton.

Sphenia antillensis Dall & Simpson.

Superfamily MACTRACEA.

Family MACTRIDÆ.

Subfamily MACTRINÆ.

Genus MACTRA (Linnæus) Lamarck.

Mactra fragilis Gmelin.
Mactra alata Spengler.

Family MESODESMATIDÆ.

Subfamily ERVILIINÆ.

Genus ERVILIA Turton.

Ervilia concentrica Gould.

Superfamily SOLENACEA.

Family SOLENIDÆ.

Genus PSAMMOSOLEN Risso.

Psammosolen sanctæ-marthæ d'Orbigny.

Genus SOLEN Linnæus.

Solen obliquus Spengler.

Superfamily TELLINACEA.

Family PSAMMOBIIDÆ.

Genus HETERODONAX Mörch.

Heterodonax bimaculatus Linnæus.

Genus TAGELUS Gray.

Tagelus gibbus Spengler.

Genus ASAPHIS Modeer.

Asaphis coccinea Martyn.

Family DONACIDÆ.

Genus DONAX Linnæus.

Donax denticulata Linnæus.

Genus IPHIGENIA Schumacher.

Iphigenia brasiliensis Lamarck.

Family SEMELIDÆ.

Genus SEMELE Schumacher.

Semele proficua Pulteney.
Semele purpurascens Gmelin.
Semele bellastriata Conrad.
Semele nuculoides Conrad.

Genus ABRA (Leach) Lamarck.

Abra æqualis Say.
Abra lioica Dall.
Abra longicallus Scacchi.

Genus CUMINGIA Sowerby.

Cumingia tellinoides Conrad var. *coarctata* Sowerby.

Family TELLINIDÆ.

Genus TELLINA Linnæus.

Tellina radiata Linnæus.

Subgenus ARCOPAGIA Leach.

Tellina fausta Donovan.
Tellina persica Dall & Simpson.
Tellina lintea Conrad.
Tellina alternata Say.
Tellina georgiana Dall.
Tellina vespuciana d'Orbigny.
Tellina lineata Turton.
Tellina martinicensis d'Orbigny.

Subgenus ANGULUS Megerle.

Tellina sybaritica Dall.
Tellina consobrina d'Orbigny.
Tellina vitrea d'Orbigny.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Genus MACOMA Leach.

Macoma constricta Bruguière.
Macoma tenta Say var. *souleyetiana* Recluz.
Macoma pseudomera Dall & Simpson.

Subgenus PSAMMACOMA Dall.

Macoma tageliformis Dall.
Macoma brevifrons Say.

Genus STRIGILLA Turton.

Strigilla carnaria Linnæus.
Strigilla rombergii Mörch.
Strigilla flexuosa Say.
Strigilla pisiformis Linnæus.

Superfamily VENERACEA.

Family PETRICOLIDÆ.

Genus PETRICOLA Lamarck.

Petricola lapicida Gmelin.

Family VENERIDÆ.

Subfamily VENERINÆ.

Genus VENUS Linnæus.

Venus rugatina Heilprin.
Venus rugosa Gmelin.
Venus brasiliana Gmelin.
Venus cancellata Linnæus.
Venus granulata Gmelin.
Venus latilirata Conrad.
Venus paphia Linnæus.
Venus pygmœa Lamarck.

Subgenus ANOMALOCARDIA Schumacher.

Venus flexuosa Linnæus.

Genus MERETRIX Lamarck.

Meretrix albida Gmelin.
Meretrix aresta Dall & Simpson.
Meretrix hebræa Lamarck.
Meretrix maculata Linnæus.

Subgenus DIONE Gray.

Meretrix circinata Born.
Meretrix dione Linnæus.

Subgenus TRANSENNELLA Dall.

Meretrix cubaniana d'Orbigny.
Meretrix culebrana Dall & Simpson.

Genus DOSINIA Scopoli.

Dosinia elegans Conrad.

Genus MYSIA Leach.

Mysia tenuis Recluz.

Subfamily CIRCINÆ.

Genus CIRCE Schumacher.

Subgenus GOULDIA C. B. Adams.

Gouldia cerina C. B. Adams.
Gouldia insularis Dall & Simpson.

Superfamily CARDIACEA.

Family CARDIIDÆ.

Genus CARDIUM Linnæus.

Subgenus TRACHYCARDIUM Mörch.

Cardium muricatum Lamarck.
Cardium leucostoma Born.
Cardium isocardia Linnæus.

Subgenus FRAGUM Bolten.

Cardium antillarum d'Orbigny.
Cardium medium Linnæus.

Subgenus PAPYRIDEA Swainson.

Cardium spinosum Meuschen.
Cardium semisulcatum Gray.

Subgenus LÆVICARDIUM Swainson.

Cardium serratum Linnæus.
Cardium (*serratum* var.?) *sybariticum* Dall.
Cardium serratum var. *lævigatum* Lam.
Cardium serratum var. *multilineatum* Dall & Simpson.

Genus PROTOCARDIA Beyrich.

Protocardia peramabilis Dall.
Protocardia tincta Dall.

Family THYASIRIDÆ.

Genus THYASIRA Leach.

Thyasira trisinuata d'Orbigny.
Thyasira conia Dall & Simpson.

Family LUCINIDÆ.

Genus CODAKIA Scopoli.

Codakia orbicularis Linnæus.

Subgenus JAGONIA Recluz.

Codakia orbiculata Montagu.
Codakia portoricana Dall.
Codakia costata d'Orbigny.
Codakia pectinella C. B. Adams.

Systematic catalogue of the mollusks of Porto Rico—Continued.

Genus Lucina (Bruguière) Lamarck.

Lucina chrysostoma Philippi.
Lucina phenax Dall & Simpson.

Genus Myrtæa Turton.

Myrtæa pristiphora Dall & Simpson.

Genus Phacoides Blainville.

Phacoides pectinatus Gmelin.

Subgenus Here Gabb.

Phacoides pensylvanicus Linnæus.
Phacoides trisulcatus Conrad, var. *blandus* Dall.

Subgenus Lucinisca Dall.

Phacoides muricatus Spengler.

Subgenus Lucinoma Dall.

Phacoides radians Conrad.

Genus Divaricella von Martens.

Divaricella quadrisulcata d'Orbigny.

Family Cyrenellidæ.

Genus Cyrenoida Joannis.

Cyrenoida americana Morelet.

Family Diplodontidæ.

Genus Diplodonta Bronn.

Diplodonta nucleiformis Wagner.
Diplodonta notata Dall & Simpson.
Diplodonta puncturella Dall.

Family Chamidæ.

Genus Chama (Linnæus) Lamarck.

Chama macrophylla Gmelin.
Chama sarda Reeve.

Subgenus Echinochama Fischer.

Chama arcinella Linnæus.

Family Vesicomyacidæ.

Genus Vesicomya Dall.

Vesicomya pilula Dall.

Family Pleurophoridæ.

Genus Coralliophaga Blainville.

Coralliophaga coralliophaga Gmelin.

Family Crassatellitidæ.

Genus Crassatellites Kruger.

Subgenus Crassinella Guppy.

Crassatellites guadelupensis d'Orbigny.
Crassatellites martinicensis d'Orbigny.

Order Anomalodesmacea.

Superfamily Poromyacea.

Family Cuspidariidæ.

Genus Cuspidaria Nardo.

Subgenus Cuspidaria s. s.

Cuspidaria obesa Lovèn.

Subgenus Cardiomya A. Adams

Cuspidaria perrostrata Dall.
Cuspidaria costellata Deshayes.
Cuspidaria ornatissima d'Orbigny.

Family Verticordiidæ.

Genus Verticordia Wood.

Subgenus Trigonulina d'Orbigny.

Verticordia ornata d'Orbigny.

Superfamily Anatinacea.

Family Lyonsiidæ.

Genus Lyonsia Turton.

Subgenus Entodesma Philippi.

Lyonsia beana d'Orbigny.

List of dredging stations of the U. S. Fish Commission steamer Fish Hawk about the island of Porto Rico, 1899.

Station No.	Date.	Locality.	Depth in fathoms.	Bottom.	Density at bottom.	Temperature at surface.	Temperature at bottom.
	1899.					°*F.*	°*F.*
6050	Jan. 13	Off San Juan	91	Sand, mud	1.026	77.0	79.0
6051	....do...	.....do	45	.....do	1.027	75.0	77.0
6052	....do...	.....do	310	.....do	1.028	79.0	73.2
6053	Jan. 16	San Juan Harbor	4-7¼	Fine sand	1.0242	79.0	78.6
6054	....do...	.....do	4¼-5¼	Sand and mud	1.025	75.8	76.8
6055	Jan. 18	Off Aguadilla	137	Sand, mud, and shells	1.0248	79.0	75.0
6056	....do...	.....do	248	.....do	1.025	79.0	75.9
6057	Jan. 19	Mayaguez Harbor	4¼	Sticky mud	1.028	75.8	77.0
6058	....do...	.....do	7¼	.....do	1.025	78.6	78.6
6059	....do...	.....do	7	.....do	1.027	78.6	84.0
6060	....do...	.....do	12	.....do	1.245	79.0	84.0
6061	Jan. 20	.....do	12-18	Sand and mud	1.024	79.0	78.6
6062	....do...	.....do	25-30	Sand, mud, and shells	1.024	78.6	75.8
6063	....do...	.....do	45-76	Rocky sand coral	1.025	78.5	68.5
6064	....do...	.....do	22-33	Sand and mud	1.0243	78.5	76.5
6065	....do...	.....do	4-6	Coral	1.0236	78.6	68.0
6066	....do...	.....do	16-17	Mud and sand	1.0246	78.6	73.2
6067	....do...	.....do	97-120	Coral	1.025	79.0	75.2
6068	Jan. 21	.....do	224-237	(?)	1.0242	82.0	73.5
6069	....do...	.....do	223-231	Sand and mud	1.0242	79.0	75.8
6070	....do...	.....do	220-225	Rocky	1.0242	78.6	75.9
6071	Jan. 24	Outside Mayaguez Harbor	....	(?)	1.0245	84.0	77.0
6072	Jan. 25	Off Point Melones	7¼	Coral, sand, shelly	1.023	78.6	78.6
6073	....do...	.....do	8	(?)	1.023	78.6	80.4
6074	....do...	Off Puerto Real	8¼	Coral and sand	1.023	78.6	78.6
6075	....do...	Off Boca Prieta	8¼	.....do	1.023	78.6	76.8
6076	Jan. 26	Off Gallardo Bank	10	.....do	1.023	78.6	79.0
6077	....do...	.....do	10¼	.....do	1.023	78.6	78.6
6078	....do...	.....do	11¼	.....do	1.023	78.6	79.5
6079	Feb. 6	Off St. Thomas	20-23	Coral	1.0235	76.8	78.2
6080	....do...	.....do	20	.....do	1.0232	78.2	76.8
6081	....do...	Off Culebra Island	17	.....do	1.0232	78.2	80.0
6082	....do...	.....do	18	Rocky and coral	1.0232	77.2	79.0
6083	....do...	Off Vieques Island	25	(?)	1.0232	78.6	78.6
6084	Feb. 8	.....do	11	Coral, sand, shells	1.023	77.2	78.8
6085	....do...	.....do	14	.....do	1.0232	77.6	78.0
6086	....do...	Off Culebra Island	14¾	Coral and sand	1.0232	77.8	77.8
6087	....do...	.....do	15¼	.....do	1.0232	76.8	76.8
6088	Feb. 10	Off Vieques Island	23	Coral	1.024	76.8	77.6
6089	....do...	.....do	21	.....do	1.0233	76.8	78.2
6090	....do...	Off Culebra Island	16	.....do	1.0232	77.2	79.0
6091	....do...	Off Vieques Island	15	.....do	1.023	77.8	78.6
6092	....do...	.....do	16	.....do	1.023	76.8	77.2
6093	....do...	Off Culebra Island	15	.....do	1.0232	76.8	77.2
6094	Feb. 11	Off Vieques Island	12	.....do	1.0235	78.6	80.4
6095	....do...	.....do	12¼	.....do	1.0236	78.6	80.4
6096	....do...	.....do	6	.....do	1.0236	79.5	81.1
6097	....do...	Off Humacao	10	.....do	1.0236	78.6	78.6
6098	....do...	.....do	12¼	.....do	1.0232	78.6	79.5
6099	....do...	.....do	9¼	.....do	1.0232	78.6	78.6

NOTE.—Owing to an inadvertence the series of numbers representing the stations, beginning with 6050 and ending with 6099, is represented on the Register of Mollusks of the U. S. National Museum, where the types illustrating this paper are preserved, by a series beginning with No. 122 and ending with No. 171. The latter numbers also appear on the labels.

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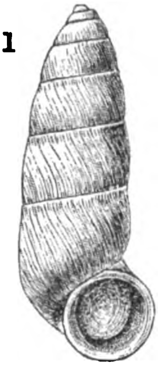
PLATE 53.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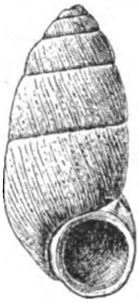
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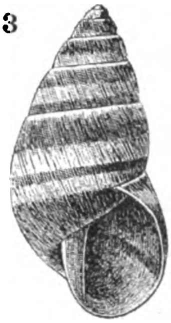
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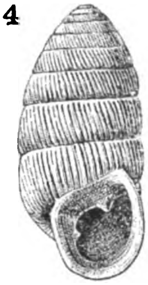
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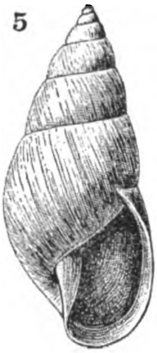
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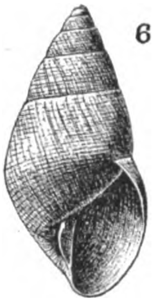
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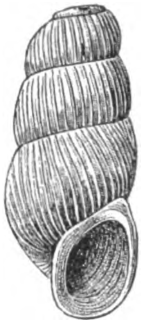
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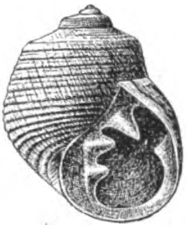
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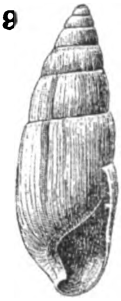
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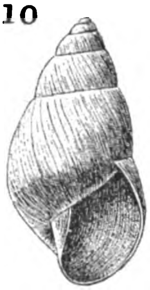
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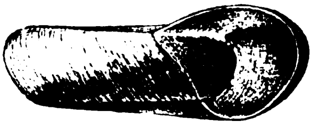
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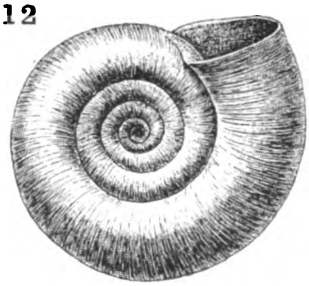
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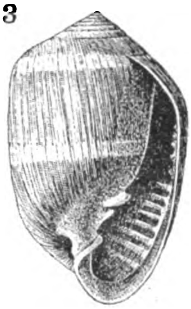
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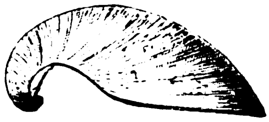
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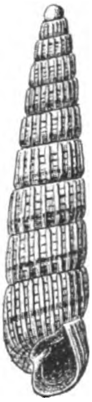
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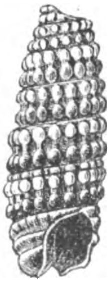
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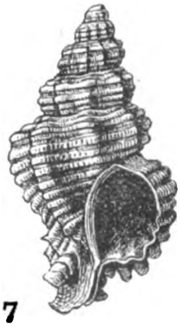
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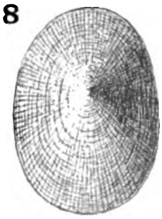
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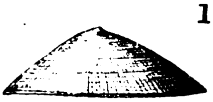
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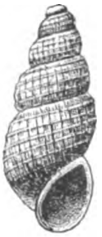
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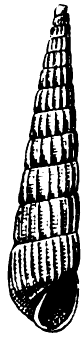
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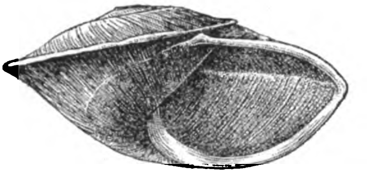
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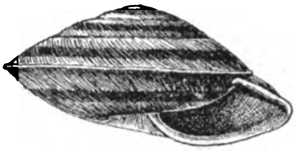
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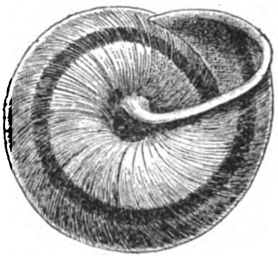
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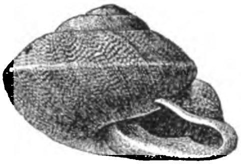
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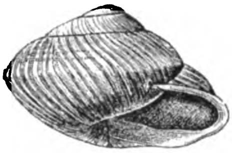
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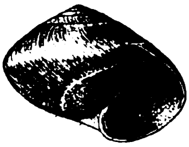
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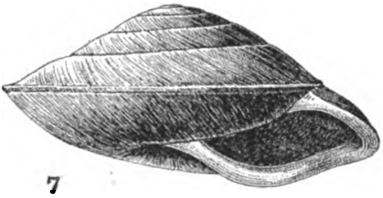
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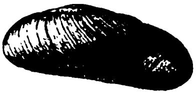
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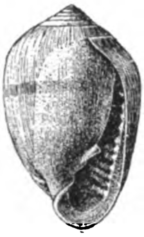
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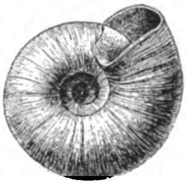
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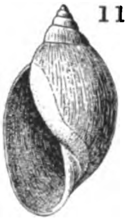
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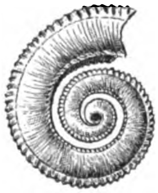
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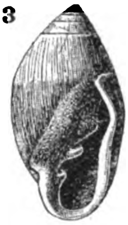
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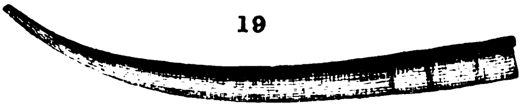
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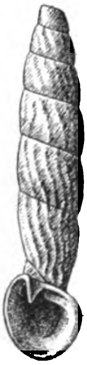
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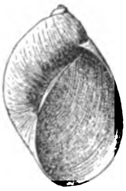
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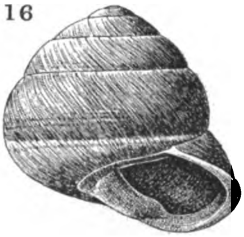
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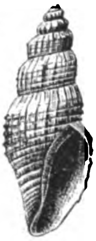
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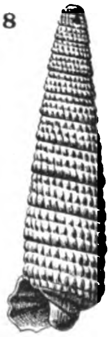
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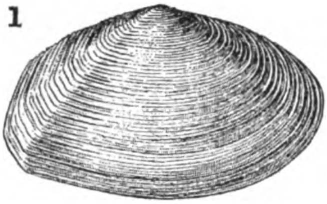
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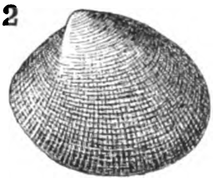
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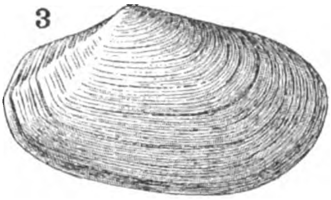
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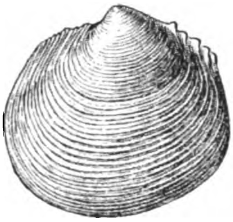
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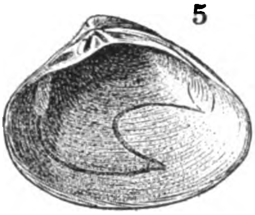
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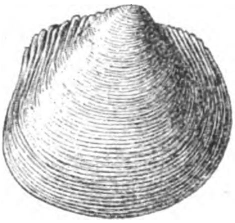
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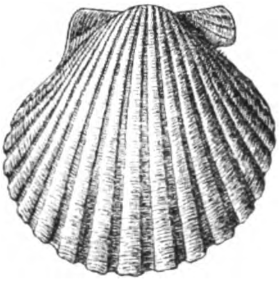
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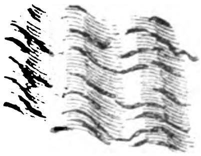
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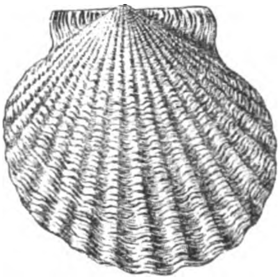
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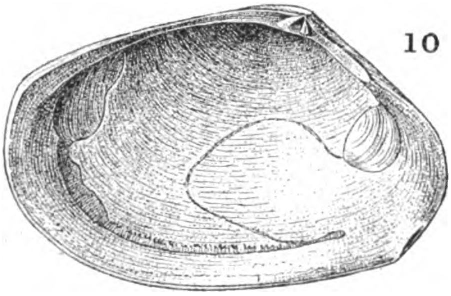
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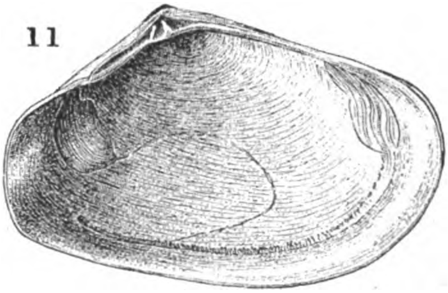
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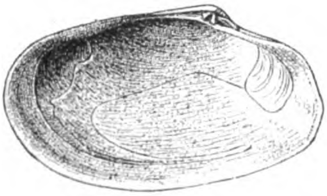
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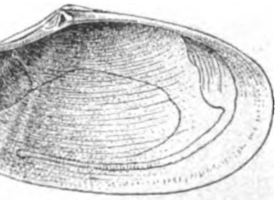
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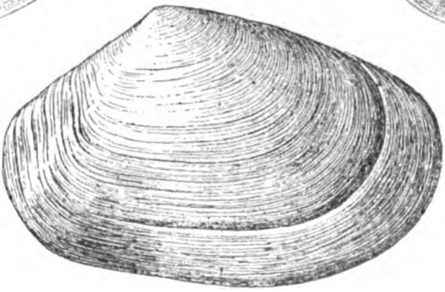
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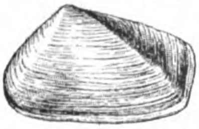
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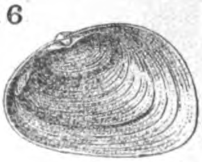
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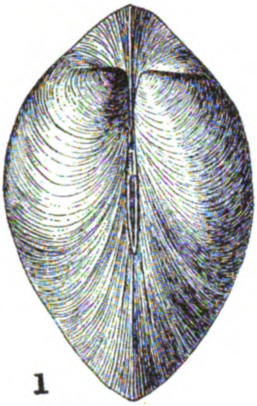

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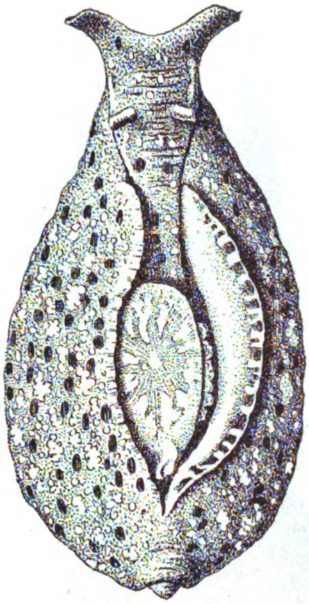

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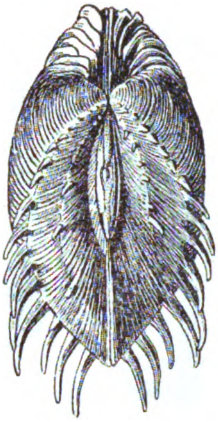

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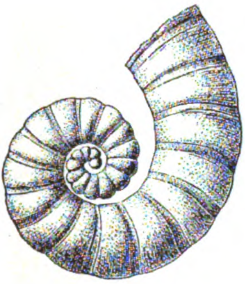

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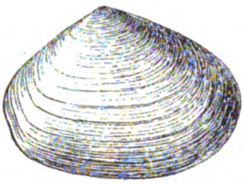

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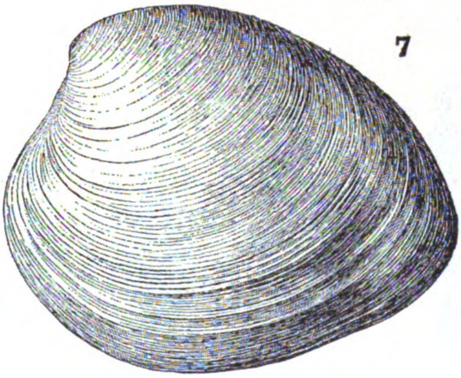

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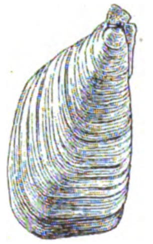

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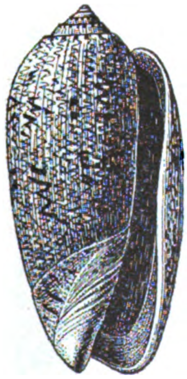

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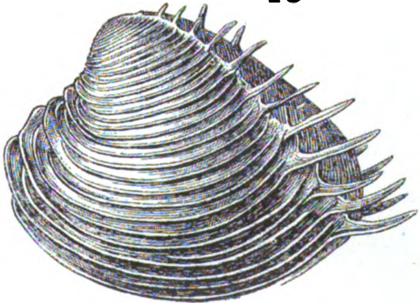

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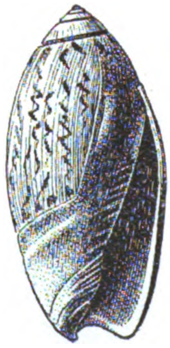

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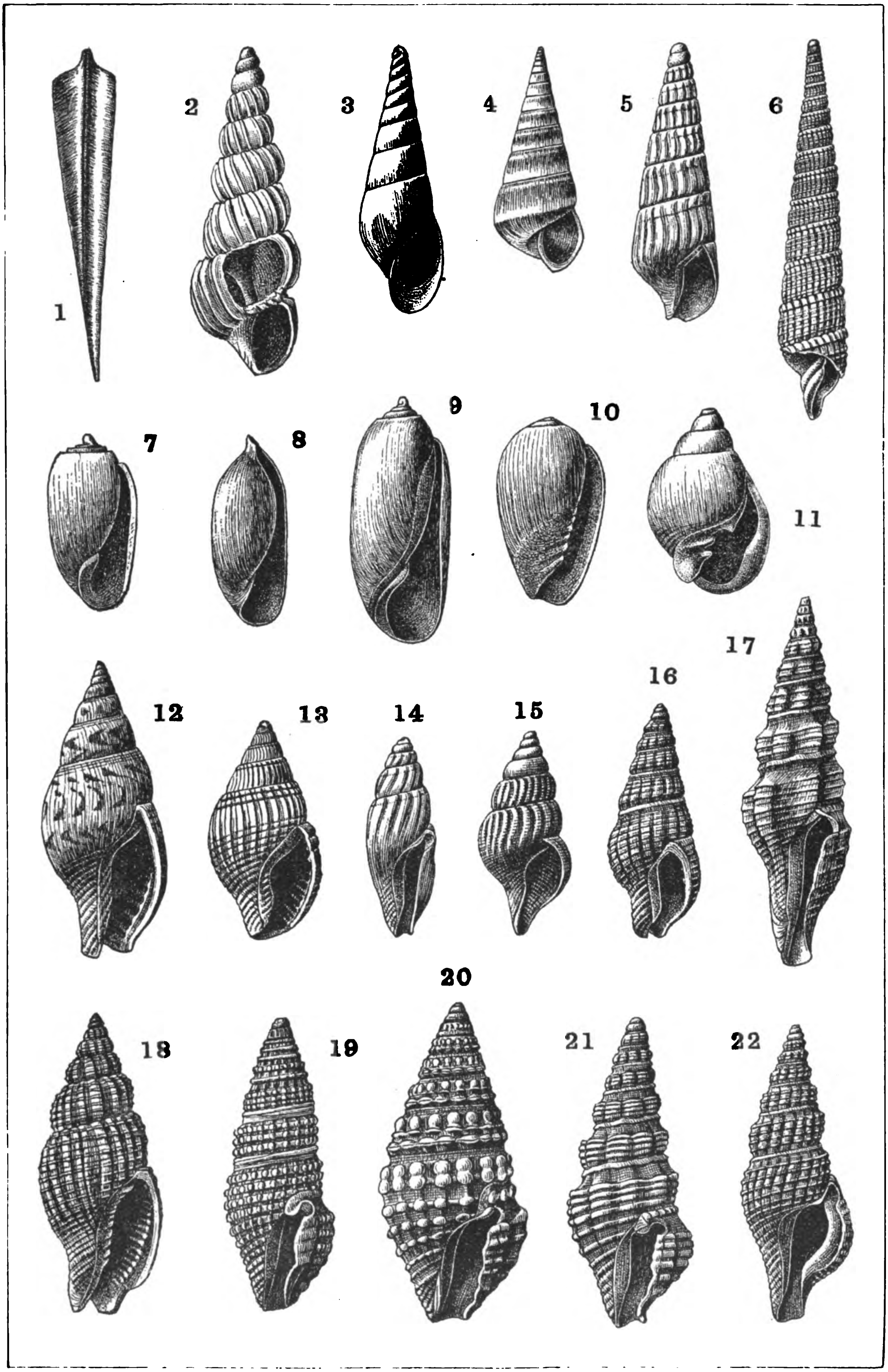

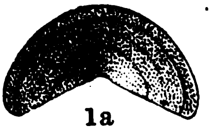
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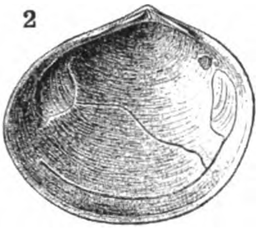

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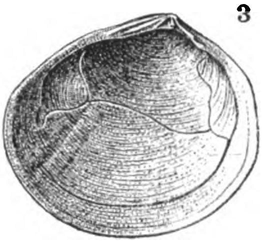

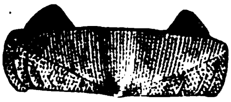
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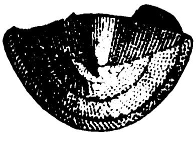
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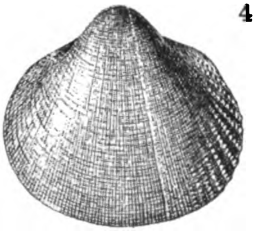

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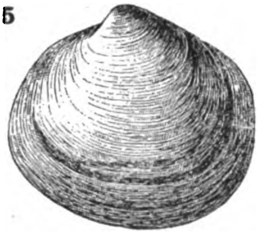

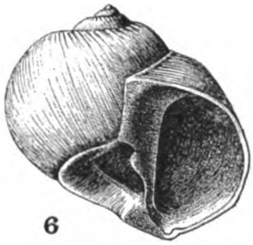
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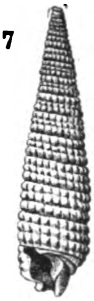

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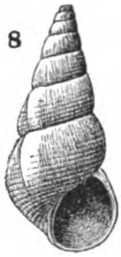

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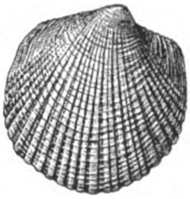

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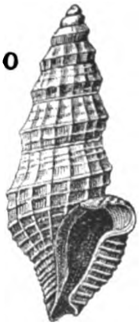

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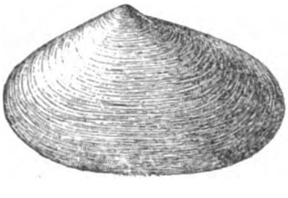

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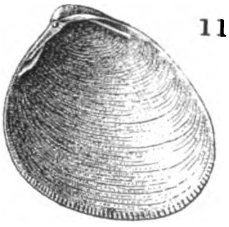

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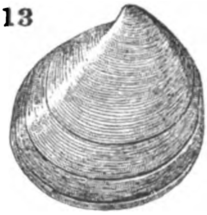

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